TWELFTH INTERNATIONAL DAIRY CONGRESS

Held in Stockholm, Sweden, August 1949

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REPORT OF
THE DELEGATION OF THE UNITED STATES
TO THE SECRETARY OF STATE

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Dairy Industry
Washington, D. C.

The Honorable
The Secretary of State
Washington, D. C.

Dear Mr. Secretary:

We have the honor to submit herewith a report of the participation in the Twelfth International Dairy Congress by the delegates representing the Government of the United States.

The Congress was held in Stockholm in August 1949, and the delegates of the United States thereto were designated by the President of the United States under the authority of letter from the Secretary of State, dated June 13, 1949, pursuant to an invitation from the Government of Sweden to the United States to participate in this Dairy Congress. The appointments by the President were transmitted to us through you.

The report herewith summarizes the work of the Congress, gives a brief account of the participation by delegates and individuals from the United States, and includes reviews prepared by United States delegates of all scientific papers presented by representatives of the governments and dairy industries of various countries. The report also contains a series of special papers pertaining to the dairy industry of Sweden, written by the United States delegates.

Respectfully submitted.

O. E. Reed, Chairman
Eric Englund, Secretary

May 12, 1950

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ORGANIZATION AND WORK OF THE TWELFTH INTERNATIONAL DAIRY CONGRESS

SCOPE OF THE INTERNATIONAL DAIRY CONGRESSES

During the First International Dairy Conference, held in Brussels in 1903, representatives of a number of participating countries founded the International Dairy Federation. One of the chief tasks assigned to the Federation from its inception was to organize international dairy congresses at which representatives of the dairy industry of various nations could meet and exchange ideas regarding scientific and economic questions of world-wide interest. Twenty-one countries are now members of the Federation, as indicated on page 4.

The Federation is credited to date with assisting the dairy industry and the national governments of the member nations in the organization of 12 international dairy congresses as follows: Brussels in 1903; Paris in 1905; The Hague in 1907; Budapest in 1909; Stockholm in 1911; Bern in 1914; Paris in 1926; London in 1928; Copenhagen in 1931; Rome and Milan in 1934; Berlin in 1937; and Stockholm in 1949.

A world dairy congress was held in the United States in 1923, at Washington, D. C., Philadelphia, Pennsylvania, and Syracuse, New York. Although the United States has never been a member of the Federation, many of the member nations sent official delegations to the 1923 congress; and the United States sent official delegations to the congresses in London, Copenhagen, Rome, Berlin, and Stockholm.

AMERICAN PARTICIPATION IN THE TWELFTH CONGRESS

On September 17, 1948, the Swedish Government extended an invitation to the United States Government to send delegates to take part in the Twelfth International Dairy Congress, which was to be held at Stockholm in August 1949 and which was then being organized under the distinguished patronage of H. R. H. the Crown Prince GUSTAF ADOLF, the International Dairy Federation, and with the support of the Swedish Government.

This invitation, transmitted to the Secretary of State from the Swedish Embassy, on behalf of the Government of Sweden, was referred to the Secretary of Agriculture who recommended to the Secretary of State that an official delegation of not less than 11 persons attend the Twelfth International Dairy Congress.

On June 13, 1949, the Secretary of State made the following announcement: "The Government of the United States accepts with pleasure this gracious invitation and will be represented at the Congress by a delegation of 11 persons...the American Ambassador at Stockholm has been instructed to inform the Foreign Office of the acceptance of this invitation..."

Official Delegates of the United States of America to the Twelfth Congress

Upon recommendation of the Secretary of Agriculture the following delegates were named by the President, and the Secretary of State notified them of their appointments:

Dr. O. E. Reed, Chief of the Bureau of Dairy Industry, United States Department of Agriculture, Washington, D. C., who also acted as chairman of the delegation.

Dr. Eric Englund, Agricultural Attache of the American Embassy, Stockholm, who also acted as secretary of the delegation.

Mr. Don S. Anderson, Assistant Director of the Dairy Branch, Production and Marketing Administration, United States Department of Agriculture, Washington, D. C.

Prof. A. W. Farrall, Head of the Agricultural Engineering Department, Michigan State College, East Lansing, Michigan.

Dr. G. E. Holm, Head of the Division of Dairy Products Research Laboratories, Bureau of Dairy Industry, United States Department of Agriculture, Washington, D. C.

Dr. Sherman E. Johnson, Assistant Chief of the Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D. C.

Dr. W. E. Krauss, Associate Director of the Ohio Agricultural Experiment Station, Wooster, Ohio.

Mrs. Ethel A. Martin, Director of the Nutrition Service, National Dairy Council, Chicago, Illinois.

Dr. H. H. Sommer, Professor of Dairy Industry, University of Wisconsin, Madison, Wisconsin.

Dr. Leland Spencer, Professor of Marketing, Cornell University, Ithaca, New York.

Dr. G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan.

In addition to the official delegates, the following persons received appointments as observers:

Prof. A. C. Baltzer, East Lansing, Michigan.
Dr. Otto F. Hunziker, La Grange, Illinois.
Mr. Robert Rosenbaum, Philadelphia, Pennsylvania.

Individuals from the United States of America who Attended the Twelfth Congress

In addition to the official delegates representing the United States Government, many representatives of State and commercial dairy organizations, State agricultural colleges and experiment stations attended the International Dairy Congress at Stockholm. The following list of individuals from the United States who attended the Congress also includes the official delegates.

Mr. Don S. Anderson, Washington, D. C.
Prof. A. C. Baltzer, East Lansing, Michigan.
Mr. Robert Czerny, Westfield, New Jersey.
Dr. Eric Englund, American Embassy, Stockholm, Sweden.
Prof. A. W. Farrall, East Lansing, Michigan.
Mrs. A. W. Farrall, East Lansing, Michigan.
Mr. Farrall, East Lansing, Michigan.
Mr. A. J. Ferm, Rockford, Illinois.
Prof. Norman S. Golding, Pullman, Washington.
Mr. M. W. Hales, Milwaukee, Wisconsin.
Mr. C. N. Hansen, Champaign, Illinois.
Mr. Leon H. Heller, Oslo, Norway.
Dr. G. E. Holm, Washington, D. C.
Dr. Otto F. Hunziker, La Grange, Illinois.
Dr. Sherman E. Johnson, Washington, D. C.

Mrs. Sherman E. Johnson, Washington, D. C.
Mr. Peter Joppe, Grand Rapids, Michigan.
Mrs. Jennie Joppe, Grand Rapids, Michigan.
Mr. John A. Knudsen, Wellsboro, Pennsylvania.
Dr. W. E. Krauss, Wooster, Ohio.
Mrs. W. E. Krauss, Wooster, Ohio.
Mr. Carl E. Lee, Milwaukee, Wisconsin.
Mrs. Ethel A. Martin, Chicago, Illinois.
Prof. Isaac Peters, Ames, Iowa.
Dr. O. E. Reed, Washington, D. C.
Mrs. O. E. Reed, Washington, D. C.
Mr. Lyman H. Rich, Logan, Utah.
Mrs. Lyman H. Rich, Logan, Utah.
Mr. Robert Rosenbaum, Philadelphia, Pennsylvania.
Mr. Simon Schwartz, Two Rivers, Wisconsin.
Mr. Helge Shipstead, Davis, California.
Dr. H. H. Sommer, Madison, Wisconsin.
Mrs. Emma H. Sommer, Madison, Wisconsin.
Dr. Leland Spencer, Ithaca, New York.
Mr. Bernhard Spur, Philadelphia, Pennsylvania.
Mr. Judson G. Squires, Omaha, Nebraska.
Mr. J. Bryan Stine, Chicago, Illinois.
Mr. S. Stoddard, New York City.
Mrs. S. Stoddard, New York City.
Dr. G. M. Trout, East Lansing, Michigan.
Mrs. G. M. Trout, East Lansing, Michigan.
Miss Trout, East Lansing, Michigan.
Mr. R. A. Trovatten, St. Paul, Minnesota.
Mr. R. Wilson, Cotati, California.
Mrs. Lenore Wilson, Cotati, California.
Prof. G. H. Wilster, Corvallis, Oregon.

COUNTRIES PARTICIPATING IN THE TWELFTH CONGRESS

Fifty-eight countries, the FAO, IFAP, and the UNICEF, sent delegations to the Congress and took part also in the exposition, tours, and conferences. A total of 2,161 persons represented the 58 countries and organizations in an official or semiofficial capacity. Following is a list of the countries and organizations and the number of participants from each.

List of Participants

Country	Participants	Country	Participants
Algeria	2	China	1
Argentine*	1	Colombia	3
Australia*	26	Cuba	2
Austria*	55	Czechoslovakia*	15
Belgian Congo	2	Denmark*	287
Belgium*	57	Dominican Republic	1
Bolivia	1	Ecuador	2
Brazil	7	Egypt	1
Bulgaria	1	Ethiopia	1
Canada*	5	Finland*	70
Ceylon	2	France*	139
Chile	5	Germany	69

List of Participants

Country	Participants	Country	Participants
Gold Coast	2	Nicaragua	2
Greece	3	Norway*	165
Guatemala	2	Panama	2
Hungary*	11	Poland	5
Iceland	9	Portugal	3
India	7	Southern Rhodesia	1
Indonesia	2	South West Africa	1
Iran	1	Spain*	32
Ireland*	13	Sweden*	499
Israel	3	Switzerland*	68
Italy*	51	Tanganyika	1
Kenya	1	Turkey	2
Luxembourg*	7	Union of South Africa	4
Malta	1	United Kingdom*	286
Mauritius	2	Uruguay*	1
Morocco	1	United States of America	95
Netherlands*	97	FAO	4
New Zealand*	14	IFAP	3
		UNICEF	5

*Countries marked with an asterisk are members of the International Dairy Federation.

OPENING OF THE CONGRESS

The Twelfth International Dairy Congress was opened on Monday, August 15, 1949, in the Concert Hall at Stockholm. More than 2,000 farmers, men of science, and commercial dairymen representing 58 countries were present. A welcoming address was given by Mr. B. von Stockenström, president of the Congress.

His Royal Highness Crown Prince GUSTAF ADOLF opened the Congress, and he said, in part:

"In considering the milk and dairy production throughout the world, one is at once struck by its enormous importance and by its colossal scope. This is but natural since a large percentage of our food is made up of milk and its derivatives. In consequence, production and handling of these commodities has resulted in a world-wide business, probably larger than any other. Thus I find in a recent publication that present world production of milk is tentatively put down at a figure not far from 150 million metric tons per annum. And yet before the war this figure was considerably higher.

"I think you will all agree with me that an early returning in this respect to at least prewar figures would be highly desirable. For no doubt the setback in dairy production caused by the war must to no mean extent be made responsible for the undernourishment, more especially of young children, which of latter years has caused so much suffering and distress. Moreover, dairy produce as a source of nourishment is of such predominant importance that material improvement in the general standard of living cannot be expected without a gradual increase in the output of milk."

Professor R. Burri of Switzerland, president of the International Dairy Federation, spoke of the relationship between the Federation and the International Dairy Congresses. He was followed by Professor

R. Mork of Norway, who presented one of the Congress's general lectures on the social and economic aspects of the liquid milk trade.

RECEPTIONS FOR VISITING DELEGATES

On Sunday evening, August 14, there was a reception for all delegates in Storkyrkan with a speech by Bishop Manfred Björkqvist.

On Monday evening, August 15, all delegates were guests at a reception given by the Federation of Swedish Farmers' Associations and the Swedish Dairies Association in the City Hall.

On Wednesday, August 17, the Swedish Minister of Agriculture gave a dinner at the Grant Hotel in honor of selected guests.

On Thursday, August 18, a banquet was given by the Congress in the City Hall for all participants.

CONGRESS SESSIONS AND EVENTS OF INTEREST

All regular sessions of the various sections of the Congress were held in the House of Parliament from August 16 to 19, mainly in the mornings. The afternoon program of each day consisted of either films or escorted tours. The films were on phases of the dairy industry and were furnished the Congress by some of the participating countries. The delegates who took the tours were shown dairy establishments, dairy and livestock farms, and points of scenic interest in and adjacent to Stockholm. Following the closing of the Congress, more comprehensive tours were arranged so that the delegates could see the dairy sections of Sweden. Some of these post-Congress tours lasted for several days and afforded an opportunity for the delegates to study Swedish agriculture in many parts of the country.

The Ladies' Program

Wives of participants had the opportunity to learn about Stockholm--its sights and social welfare, Swedish history, art and art handicraft--by going on the sightseeing tours, one-day excursions, and study tours that were arranged by the Ladies' Committee of the Congress. Each day's program was arranged in a different vein, such as "commercial day," "cultural day," and "social and shopping day."

CLOSING OF THE CONGRESS

The final session of the Congress took place in the Concert Hall at 2 p. m., Friday, August 19. General Director B. von Stockenström, president of the Congress, opened the final Plenary Session. Resolutions resolved during the Congress were read and approved. Then after several appreciatory comments by Congress officials, the president declared the Twelfth International Dairy Congress to be closed.

RECOMMENDATIONS CONCERNING FUTURE CONGRESSES

The official delegates of the United States are of one accord that this country has much to gain by being represented at all future

international dairy congresses. Discussion and study of the results produced by scientific dairy research in many countries afford immeasurable advantages to dairy interests in the United States. Participants in the Congress presented a total of 409 scientific papers covering all phases of the dairy industry, and of this number 43 papers were from the United States. Moreover, aside from the benefits to be gained by an exchange of ideas on the numerous scientific and practical subjects relating to the dairy industry, there is the equally important result that may be expected through development of international understanding and good will. A meeting of delegates from 58 countries, as was the case at the Stockholm Congress, is of such far-reaching importance from both of these viewpoints that the United States should be represented at all such future congresses.

The American delegation wishes to thank the officials of the Swedish Government and of the Twelfth International Dairy Congress, and in particular Waldemar Ljung, the Secretary-General, for the many honors and courtesies extended to the delegation on this occasion.

REPORT OF THE SESSIONS OF THE CONGRESS

The program for the presentation and discussion of the scientific papers was carried out under six sections as follows:

1. Milk production, hygiene, and control.
2. Physics, chemistry, and microbiology.
3. Dairy industrial technique
   a. Processing
   b. Engineering
   c. Building.
4. Economics and trade
   a. Operational economics
   b. Trade
   c. Standardization.
5. Organization of the dairy industry.
6. Tropical dairying.

The work of the respective sections was carried out from August 15 to August 19, during the morning hours. Section I dealt with 4 subjects; section II, with 5 subjects; section III, with 12 subjects; section IV, with 9 subjects; section V, with 2 subjects; and section VI, with 4 subjects.

A general reporter was assigned for each topic. With the assistance of one or two collaborators, each general reporter prepared a summary of all papers that were submitted under his topic, and the summarized report was the only paper read to the delegates.

The official languages of the Congress were English, French, German, and Scandinavian. The general reports were presented in one of the three first-named languages.

A set of seven volumes containing all Congress presentations is available. The first five volumes contain in full the 409 submitted papers. The sixth volume contains the 33 general reports, and the seventh volume is a report of the actual Congress and a record of the oral debates. The papers are printed in the language in which they were submitted and conclude with summaries in all three languages. Orders for these volumes can be sent to the Twelfth International Dairy Congress, Postbox 642, Stockholm, Sweden. The prices are: Unbound,

Volumes 1-7, 50 Swedish kronor; bound, Volumes 1-7, 90 Swedish kronor.

For the purpose of this report to the Congress, members of the American delegation have reviewed the most interesting papers and prepared brief abstracts. Several special papers have also been prepared as follows:

The Dairy Industry in Sweden, by Sherman E. Johnson.
Breeds of Dairy Cattle in Sweden, by O. E. Reed.
Dairy Cattle Nutrition in Sweden, by W. E. Krauss.
Cooperative Dairy Marketing in Sweden, by Leland Spencer.
Dairy Products in Sweden, by H. H. Sommer.
Dairy Products Research in Sweden, by G. E. Holm.
Consumption of Dairy Products in Sweden, by Mrs. Ethel A. Martin.
Observations on Fluid Milk Processing in Sweden, by G. M. Trout.
Dairy Machinery and Equipment in Northwestern Europe, by A. W. Farrall.
Government Action in Relation to the Dairy Industry, by Don S. Anderson.

SECTION I.--MILK PRODUCTION, HYGIENE AND CONTROL

Sixty-seven papers were submitted for discussion under Section I, Milk Production, Hygiene and Control. The subject matter was presented under four different subjects, as follows:

Subject 1.--The Influence of Feeding on the Composition of Milk and on the Quality of Dairy Products.

Subject 2.--Milking (Including Machine Milking) and the Treatment of Milk before Delivery to the Dairy.

Subject 3.--The Payment for Milk on a Quality (Compositional and Hygienic) Basis on Delivery to the Dairy.

Subject 4.--Methods to be Employed by the Dairy Industry in Eradicating Contagious Diseases in Dairy Cattle.

Comments, Section I, Subject 1

The 16 papers that were submitted for discussion under Subject 1, The Influence of Feeding on the Composition of Milk and on the Quality of Dairy Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. K. Breirem, of Norway, was the general reporter.

Dr. W. E. Krauss, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers especially for this report.

THE INFLUENCE OF FEEDING ON THE COMPOSITION OF MILK AND ON THE QUALITY OF DAIRY PRODUCTS

Comments by W. E. Krauss, Associate Director of the Ohio Agricultural Experiment Station, Wooster, Ohio

This subject was discussed under four headings: (1) Composition of milk; (2) consistency of butter; (3) flavor and aroma of milk and butter; and (4) the suitability of the milk for cheesemaking and for condensed milk manufacture.

1. A general summary of the world's literature was given. In general, there is agreement that under practical conditions and using ordinary feeds there is little relationship between the nature of the feed and the percentage of fat in the milk produced. Norwegian experiments had shown that extreme underfeeding of protein and energy for 3 months after calving lowered the fat percentage from 4.26 to 3.67. Swedish work pointed to an increase in the fat percentage of milk during early lactation when heavy feeding was practiced during calfhood and heiferhood. As a rule the feeding of high-fat feeds such as oil cakes increases the fat content of milk which may or may not be real. Work done in Germany, Denmark, and Sweden has shown heavy increases in milk yield and marked decreases in fat percentage when cows were turned out to young luxuriant pasture. This was attributed to disturbances in rumen fermentation.

Discussion of other factors affecting the fat percentage of milk cited results in keeping with generally accepted views in the United States, including work on the feeding of iodinated casein.

Some evidence from Denmark, Norway, and Finland suggests that the protein content of milk, and particularly casein, can be lowered by feeding protein-deficient rations. In England, New Zealand, Holland, and Switzerland, the solids-not-fat, and especially the protein content of milk, was lowered by feeding low-energy rations.

Iodine, zinc, manganese, and cobalt were cited as minerals whose concentration in milk can be altered through feeding.

Discussion on the variation of vitamins in milk centered around vitamin A and carotene with full recognition of the significant finding of the cooperative study made in the United States, and of the work on the effect of quality of hay, pastures, and grass silage.

2. Consistency of butter is associated with iodine number. A relationship was shown in Dutch experiments between the nature and stage of the roughage and the iodine number of milk fat, and in Norway the feeding of A.I.V. silage tended to give a soft butter.

3. Time of feeding seemed to be the important consideration in the discussion on relationships between feed and aroma. The tendency of high quality roughages to reduce the susceptibility of milk to oxidized flavors was pointed out.

4. The weight of evidence points to a lack of relationship between the feeding of silage and changes in milk quality that are unfavorable to cheesemaking, and that secondary infections rather than changes in milk composition are the causes of faulty fermentations in cheese. In Germany, however, the stability of condensed milk in storage decreased as the proportion of silage milk increased.

In the discussion on this report it was pointed out that much of the work reported had academic interest and the question was raised as to the practical application of the results in view of the present availability of substances that can be added to milk to overcome any defects. No satisfactory answer was forthcoming.

Comments, Section I, Subject 2

The 22 papers that were submitted for discussion under Subject 2, Milking (Including Machine Milking) and the Treatment of Milk Before Delivery to the Dairy, were summarized by a general reporter for the Congress, and his summary was the only paper read to the assembled delegates. S. O. Koch, of Denmark, was the general reporter.

Dr. G. M. Trout, who was an official delegate for the United States,

has prepared the following summary of the more pertinent papers, especially for this report.

MILKING (INCLUDING MACHINE MILKING) AND THE TREATMENT OF MILK BEFORE DELIVERY TO THE DAIRY

Comments by G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan

A review of some 19 papers submitted under this title showed marked disagreement among authorities on certain phases of the subject. General agreement seemed to be manifest that the milking process should be carried out painlessly and be completed quickly, regardless of hand or machine milking. Both moist and dry (antiseptic vaseline) washing of the udder before milking as a means of controlling mastitis had its advocates. Likewise, several methods of washing and care of milk utensils were prescribed. The problems connected with milk and the treatment of milk elucidated through the papers submitted suggested that:

1. A guide should be worked out for the cleaning of udder and teats before milking, with particular regard to the use of chlorine-solution which, when correctly used, may both contribute to reducing the risk of spreading infection, and act as an agent in reducing the initial number of germs in the milk.
2. A standard method be worked out for ascertaining the cleanliness of the milk utensils, in order to create the possibility of comparing the results.
3. A standard guide be worked out for the cleaning and disinfection of the milking machines, and that the dairy industry try at the same time to insure that this guide is followed closely by the manufacturers in the instruction of the producers in the use and treatment of the machines.

Comments, Section I, Subject 3

The 12 papers that were submitted for discussion under Subject 3, The Payment for Milk on a Quality (Compositional and Hygienic) Basis on Delivery to the Dairy, were summarized by a general reporter for the Congress, and his summary was the only paper read to the assembled delegates. P. N. Boekel, of Holland, was the general reporter.

Dr. G. M. Trout, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

THE PAYMENT FOR MILK ON A QUALITY (COMPOSITIONAL AND HYGIENIC) BASIS ON DELIVERY TO THE DAIRY

Comments by G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan

Reports submitted in this discussion did not allow of a general conclusion regarding the most desirable system of payment for milk on a composition and quality basis because of the greatly different ways in which the subject had been approached. There is, however, a general endeavor to make payments for milk on a composition basis dependent on the nonfat solids content as well as on the butterfat content.

The author concluded and recommended that: (a) As far as the exclusive production of butter was concerned, it was sufficient to base the payment for milk on the butterfat content; (b) if the milk were to be used exclusively for the manufacture of cheese and milk products or for liquid consumption, price was dependent on components of milk other than fat; (c) milk price be based in part on its hygienic quality--smell, reduction time, cleanliness, and presence of streptococci--on farm inspection and control of disease. Fluctuations on the protein content of milk, whether dependent on the butterfat content, need to be investigated so that in selecting of dairy cattle the presence of these valuable components of the milk can be taken into consideration.

Comments, Section I, Subject 4

The 17 papers that were submitted for discussion under Subject 4, Methods to be Employed by the Dairy Industry in Eradicating Contagious Diseases in Dairy Cattle, were summarized by a general reporter for the Congress, and his summary was the only paper read to the assembled delegates. P. Kästli, of Switzerland, was the general reporter.

Dr. W. E. Krauss, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

METHODS TO BE EMPLOYED BY THE DAIRY INDUSTRY IN ERADICATING CONTAGIOUS DISEASES IN DAIRY CATTLE

Comments by W. E. Krauss, Associate Director of the Ohio Agricultural Experiment Station, Wooster, Ohio

Three diseases of dairy cattle were discussed: Bovine tuberculosis, Bang's disease, and streptococcal mastitis.

Various measures involving hygiene, testing and elimination, price premiums for noninfected milk, government control and financing, vaccination, and treatment were discussed and evaluated. Numerous general recommendations were made, practically all of which are in effect in the United States.

The report incidentally reported white scours, pyogenes and salmonella infections, diphtheria, indigestion, parasites, and trichomoniasis, and avoided foot-and-mouth disease entirely.

SECTION II.--PHYSICS, CHEMISTRY, AND MICROBIOLOGY

One hundred and twenty papers were submitted for discussion under Section II, Physics, Chemistry, and Microbiology. The subject matter was presented under five different subjects. The subjects, and the name of the general reporter for each subject, are as follows:

Subject 1.--The Physical Structure of Milk and Dairy Products; H. Mulder, Holland.

Subject 2.--The Chemical Composition of Milk and Dairy Products; J. Keilling, France.

Subject 3.--Oxidation Processes in Milk and Dairy Products; G. E. Holm, U. S. A.

Subject 4.--Microbiological Processes in Milk and Dairy Products;

A. T. R. Mattick, Great Britain.
Subject 5.--Analytical and Research Methods; A. C. Andersen, Denmark.

Dr. G. E. Holm, who was an official delegate for the United States, has prepared the following summary of the papers presented under the five subjects, especially for this report.

SECTION II, Physics, Chemistry, and Microbiology

Comments by G. E. Holm, Bureau of Dairy Industry,
United States Department of Agriculture, Washington, D. C.

At the meetings of the Twelfth International Dairy Congress the physical, chemical, and microbiological problems of milk and dairy products were discussed in sectional meetings devoted to the subjects of (a) physical structure, (b) chemical composition, (c) oxidative spoilage, (d) microbiological processes, and (e) analytical and research methods. Work was reported of studies on the application of special techniques in colloid and physical chemistry to define the properties and explain the behavior of milk protein and fat dispersions, i.e., creaming, gelation, coagulation, particle size, hydration, etc. Though progress has been made, the reports indicate that we still do not have a clear picture of the physical structure of milk and variations in its structure during handling, processing, and storage. Nor do we have the explanations for some of the anomalous behaviors of some milks and milk products. Similarly with respect to composition. The precise chemical and physical nature of the constituents is still in question, as indicated by reports on the nature of the calcium caseinate system, the fat acid composition of the fat, the types of proteolysis in cheese,aand the unidentified vitamins in milk.

The spoilage of dairy products is still being studied in its extensive phase. The relationship of physical conditions, composition, and other factors, as well as the use of antioxidants has been explored quite thoroughly. Some studies of the fundamental reactions concerned, and the accurate measurement of the susceptibility to and degree of spoilage of fats, were also reported.

The accurate determination of moisture and fat in dairy products, especially in cheese and dried milks, has received some attention. Studies on measurements of the hardness and texture of cheese have added to our knowledge of the correlated factors concerned, but have not established definitely the tests that would be most beneficial to a knowledge of the desired properties of this product. The work reported on the phosphatase test for pasteurization, especially its use on cheese, was of special interest.

The studies of greatest interest in microbiological subjects seemed to be those of butter cultures and butter aroma and those dealing with bacteriophage and its control in the cheese industry. Other studies in this field dealt with proteolysis in cheese and lipolysis by molds, and the role of microorganisms in causing defects in butter and other dairy products.

An outstanding characteristic of the programs in these sections as evidenced by the papers presented was the emphasis which is being placed by everyone on fundamental work in an effort to explain anomalous behaviors of milk constituents and products.

SECTION III.--DAIRY INDUSTRIAL TECHNIQUE

Seventy-seven papers were submitted for discussion under Section III, Dairy Industrial Technique. The subject matter was presented under twelve different subjects, as follows:

(a) Processing
- Subject 1.--The Treatment of Milk for Human Consumption.
- Subject 2.--Continuous Buttermaking.
- Subject 3.--Storage of Cheese.
- Subject 4.--Ice Cream Manufacture.
- Subject 5.--Cleaning of Dairy Equipment and Control of the Efficiency of the Cleaning Processes.

(b) Engineering
- Subject 1.--Concentration of Milk and Milk Products.
- Subject 2.--Temperature Control in the Storage of Dairy Products.
- Subject 3.--Standardization of Materials and Fittings for Dairy Machinery.
- Subject 4.--Pasteurization and Cooling of Milk in the Manufacture of Dairy Products.

(c) Building
- Subject 1.--Planning of Dairies According to Size and Functions.
- Subject 2.--Construction of Dairies and Choice of Building Material.
- Subject 3.--Disposal of Dairy Waste Water.

Comments, Section III (a), Subject 1

The 15 papers that were submitted for discussion under Subject 1, The Treatment of Milk for Human Consumption, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. Dr. G. M. Trout, an official delegate for the United States, was the general reporter.

THE TREATMENT OF MILK FOR HUMAN CONSUMPTION

Comments by G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan

In this paper, the writer reviews 15 papers on the subject submitted to the Congress. These papers showed (a) a trend toward higher pasteurization temperatures; (b) closer inspection of raw materials, plants and processes, to insure freedom from coliform contamination and superior keeping quality of the pasteurized product; (c) application of physicochemical principles to improve the old and create new milk products; and (d) recognition and acceptance of many new problems and processes incident to homogenization.

Comments, Section III (a), Subject 2

The seven papers that were submitted for discussion under Subject 2, Continuous Buttermaking, were summarized by a general reporter for the

Congress, and his paper was the only one read to the assembled delegates. N. King, of Sweden, was the general reporter.

Prof. A. W. Farrall, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

CONTINUOUS BUTTERMAKING

Comments by A. W. Farrall, Head of the Agricultural Engineering Department, Michigan State College, East Lansing, Michigan

Great interest was shown in the subject of continuous buttermaking. Both in Europe and America new processes are now under tests in commercial dairy plants. Five principal types of machines are described. These are the Fritz, the Alpha Process, the New Way Process, the Cherry-Burrell Process, and the Creamery Package Process.

Each of the new processes was described briefly; however, the principal discussion centered around the general advantages of continuous manufacture from the standpoint of the quality and labor saving. It appeared that the butter made from the several different processes is being used in commerce and that the next few years would see the ultimate perfection of the continuous process and result in improved quality of butter and lower cost of manufacture. Dr. Mohr, Director of Kiel Institute, Germany, has made exhaustive studies of the comparative structure of batch and continuous type butter.

Comments, Section III (a), Subject 3

The six papers that were submitted for discussion under Subject 3, Storage of Cheese, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. E. Capstick, of Great Britain, was the general reporter.

Dr. H. H. Sommer, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

STORAGE OF CHEESE

Comments by H. H. Sommer, Professor of Dairy Industry, University of Wisconsin, Madison, Wisconsin

Following Capstick's general report, Chairman Taylor invited comments from authors of papers.

Golding commented briefly on canned Cheddar cheese. He pointed out that such canning is in limited practical use. Within Golding's knowledge, one firm is shipping in carload lots to a company that operates a chain of restaurants.

Chairman Taylor then introduced the question of wrapping cheese in pliofilm wrappers. A Swedish delegate responded. He pointed out that wrapping of Swedish cheese is a problem because of holes in the cheese. The process that has proved successful is to dip the cheese in formol or alcohol, then in an aseptic room with Sterilamps, trim rind, cut and wrap in film wrapper. Such wrapped cheese keeps well for one month.

McClelland (Glasgow) then asked Capstick to comment on "mechanical

turning frames." Capstick's comment was that they require more space than ordinary shelves, and this fact limits the use of invertible frames.

Capstick commented on cheese mites, pointing out that they thrive only on a relatively dry surface. Accordingly, the making of Stilton cheese in recent years with a slimy surface has greatly reduced the mite problem.

Capstick also commented on the fact that Britain asked Australia and New Zealand to omit the "waxing" of cheese, whereas the Swedish film showed conveyor belt and automatic wax dipping of cheese.

Comments, Section III (a), Subject 4

The five papers that were submitted for discussion under Subject 4, Ice Cream Manufacture, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. Dr. H. H. Sommer, an official delegate for the United States, was the general reporter.

ICE CREAM MANUFACTURE

Comments by H. H. Sommer, Professor of Dairy Industry,
University of Wisconsin, Madison, Wisconsin

The papers that were reviewed were disappointingly lacking in substance, and in preparing the 30-minute general report, the reporter therefore availed himself liberally of the directive to reporters to supplement the papers by contemporary material of his own choosing. It also affected the choice of the subject matter in the paper which the general reporter was asked to submit.

Bogod's paper did little beyond reciting conventional and well-known methods in the manufacture of ice cream. Sjetne's paper comparing conventional and rapid hardening applied to ice creams with 25.4 percent total solids and 34.85 percent total solids, and concluding that rapid hardening is most beneficial in the case of the former, is entirely logical and predictable.

Baetsles' paper revealed sanitary conditions in the production and distribution of ice cream in Belgium, and the need for improvement. He suggested standards that coincided quite closely with quality conceptions here, but it was surprising that he specified bacterial standards on a "per ml." basis instead of a "per gram" basis. It was also surprising that he considered ice cream as a luxury item for which legal composition standards are "nonsense."

Dahlberg's paper on the food value of commercial vanilla ice cream presented concise "average" content figures for specific nutrients per 100 grams of ice cream, which were reproduced in the general report and needed no extended comment.

The paper by Sommer on "Sandiness in Ice Cream" was selected because it fitted in well with the general context of the general report as it was developed under the invitation to "supplement with contemporary material." This paper stressed the fact that sandiness is not developed by "heat shocking." This expression directs attention to the concept that variation in temperature is an important contributory factor, when in fact variation in temperature is not a factor as such. The temperature level at which the ice cream is kept is the important

factor. To become sandy the ice cream must be at a temperature where the "unfrozen portion" is sufficiently low in viscosity to permit crystallization.

There were a few questions after the general report concerning stabilizers and concerning the "balancing of the ice cream mix." The latter question was confused and it was impossible to elicit a clear understanding of the questioner's concept; he obviously had ideas that were at variance with anything that would be suggested to us by this term.

Comments, Section III (a), Subject 5

The 14 papers that were submitted for discussion under Subject 5, Cleaning of Dairy Equipment and Control of the Efficiency of the Cleaning Processes, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. W. Dorner, of Switzerland, was the general reporter.

Dr. G. M. Trout, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

CLEANING OF DAIRY EQUIPMENT AND CONTROL OF THE EFFICIENCY OF THE CLEANING PROCESSES

Comments by G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan

The writer explained that cleaning means the removal of all residues as well as the killing of bacteria, or disinfection of all surfaces coming in contact with milk. Badly cleaned milk containers can add hundreds of thousands or even millions of bacteria in each milliliter of milk. Other sources of contamination often are insignificant in comparison. For proper cleaning, bacteriologically and chemically fit water must be used. Hard water is wasteful of detergent and initiates deposits of milk residues. Plant surfaces should be hard, crevice-free, and not susceptible to corrosion and abrasion. To prevent electrolytic corrosion between wet metals, the whole equipment of a dairy plant should be made of the same metal.

There is no single detergent mixture available which will fulfill the many and varied requirements in the modern dairy. The detergent used should have good solvent and emulsifying properties, and should show a minimum tendency of suspended matter to coalesce as well as to be noncorrosive to metals. Its germicidal effect should not be dependent upon high alkalinity or any appreciable temperature/time combination. Personnel should be kept informed of the results of laboratory tests and be instructed through written directives as to the correct cleaning procedure.

The writer gave specific directions for the cleaning of milk cans, transport and storage tanks, pasteurizers made of one or more different metals, milk bottles, and churns. Each of these require a specific cleaning technique.

Quaternary ammonia compounds as chemical sterilizers of milk plants show about the same germicidal power as the available chlorine in hypochlorites. The bactericidal power increases with temperature and pH, but decreases in the presence of milk proteins, especially if fat is

present, but much less than comparable solutions of hypochlorites. At a dosage of 0.2 percent in milk, a quaternary ammonium prevented the growth of lactic acid bacteria while Gram-negative bacteria (coli-aerogenes) thrived on it. Thus, use of too low concentration of quaternary ammonia compounds can cause the predominance of Gram-negative bacteria on the treated implements.

The control of physical cleanliness throughout a plant is effected through close inspection, and using various testing solutions and media on equipment and product.

Comments, Section III (b), Subject 1

The four papers that were submitted for discussion under Subject 1, Concentration of Milk and Milk Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. G. J. Blink, of Holland, was the general reporter, but the report was presented by E. L. Crossley, of Great Britain.

Dr. W. E. Krauss, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

CONCENTRATION OF MILK AND MILK PRODUCTS

Comments by W. E. Krauss, Associate Director of the Ohio Agricultural Experiment Station, Wooster, Ohio

Included in the report was a description of a whole milk drying method involving raising the preheating temperature to 190° F. for 20 seconds instead of 160-165° F. This extended the keeping quality considerably due to the formation of sulfhydril. Reduction of bacterial count resulted and vitamin content was improved.

Also described was a method of concentrating whey by freezing, at a cost only 60 percent that of evaporation. Because of considerable loss of total solids, this process may not be commercially possible.

A new use for a vacreator was reported. It was shown in work done at Manitoba University that a vacreator could be used for concentrating skim milk and buttermilk suitable for ice cream mixes. It was anticipated that a special apparatus could be built, using the principles of the vacreator, and provide a new method for evaporating milk.

A new apparatus for deodorizing cream has been devised and patents applied for in Holland and Switzerland. The apparatus uses the principle of expansion of small droplets of cream in contact with steam at low pressure.

Comments, Section III (b), Subject 2

The three papers that were submitted for discussion under Subject 2, Temperature Control in the Storage of Dairy Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. G. Loftus Hills, of Australia, was the general reporter.

Dr. H. H. Sommer, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

TEMPERATURE CONTROL IN THE STORAGE OF DAIRY PRODUCTS

Comments by H. H. Sommer, Professor of Dairy Industry,
University of Wisconsin, Madison, Wisconsin

Hills classified dairy products according to temperature requirements in storage. Products stored:

I. At -25° C. or lower
   (a) Ice cream
   (b) Frozen milk
   (c) Frozen concentrated milk.
II. At ca -15° C.
   (a) Butter
   (b) Plastic cream.
III. At 0° to +10° C.
   (a) Milk
   (b) Milk drinks
   (c) Concentrated milk
   (d) Cream
   (e) Cottage cheese
   (f) Cold stored cheese.
IV. At +10° C. to 20° C.
   (a) Cheese during ripening
V. Preferably below +15° C.
   (a) Sweetened condensed milk
   (b) Evaporated milk
   (c) Sterilized milk
   (d) Sterilized cream.
VI. The most temperature-resistant products, but which may well be kept under temperature regulation for longer storage:
   (a) Dried milks
   (b) Dried buttermilk
   (c) Processed cheese
   (d) Cheese spreads
   (e) Dried cheese
   (f) Dried whey
   (g) Butter concentrate or butter oil.

He then discussed the technology of temperature control, and specific types of refrigeration and controls in relation to the above indicated needs.

Comments, Section III (b), Subject 3

The three papers that were submitted for discussion under Subject 3, Standardization of Materials and Fittings for Dairy Machinery, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. J. Matthews, of Great Britain, was the general reporter.

Prof. A. W. Farrall, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

STANDARDIZATION OF MATERIALS AND FITTINGS FOR DAIRY MACHINERY

Comments by A. W. Farrall, Head of the Agricultural Engineering Department, Michigan State College, East Lansing, Michigan

Mr. Matthews points out the wide variation in the method of construction and sizes of dairy equipment and fittings in Europe. It is apparent that very little standardization of European pipe and fittings has been accomplished at the present time. He proposes that a European presumably metric standard should be attempted in spite of difficulties which have been encountered in Scandinavia.

Mr. Matthews points out and describes the remarkable progress made in the United States in standardization through the cooperation of the three associations, namely, the milk dealers, the milk sanitarians, and the dairy industries supplies association.

Mr. Matthews suggests that standardization might well be applied to many other items of dairy equipment such as dimensional standards in washing and filling machines, and also such items as small sterilizing boilers for farm use, and milk strainers, milk cans, and milk coolers.

Comments, Section III (b), Subject 4

The four papers that were submitted for discussion under Subject 4, Pasteurization and Cooling of Milk for the Manufacture of Dairy Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. H. Jensen, of Denmark, was the general reporter.

Dr. G. M. Trout, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

PASTEURIZATION AND COOLING OF MILK FOR THE MANUFACTURE OF DAIRY PRODUCTS

Comments by G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan

The writer discussed this subject from the standpoint of (a) design, construction, and mode of working of the apparatus; (b) technical equipment for control and automatic operation; (c) adaptability of the apparatus for the purposes of cleaning; (d) suitability of design for the correct treatment of the milk; (e) nature of the materials and their influence on the milk; (f) thermal economy of the apparatus; (g) heating and cooling media employed in the working of the apparatus; (h) subsidiary machinery.

In general, high-temperature, short-time pasteurization seems to be taking the place of batch pasteurizers. Solutions of sodium or calcium-chloride for cooling continue to be corrosive despite pH adjustments. Replacing these solutions with mixtures of 60 percent potassium carbonate and 40 percent sodium bicarbonate in a 20 percent water solution, yielding a pH value of 9.6, was more suitable. Cold accumulation methods of cooling, using off-peak loads of electricity, were gaining favor in Sweden.

Comments, Section III (c), Subject 1

The six papers that were submitted for discussion under Subject 1, Planning of Dairies According to Size and Function, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. Prof. A. W. Farrall, an official delegate for the United States, was the general reporter.

PLANNING OF DAIRIES ACCORDING TO SIZE AND FUNCTION

Comments by A. W. Farrall, Head of the Department of Agricultural Engineering, Michigan State College, East Lansing, Michigan

Information supplied from England, France, Sweden, Denmark, and Hungary indicates that there is a general appreciation of the importance of more thorough planning of dairy plants to provide the most efficient use of labor, low cost of processing operations, and at the same time make an attractive structure which will give a favorable impression to consumers of dairy products.

Greatly increased attention is being given to sanitary aspects of dairy plant construction. This is particularly true in the United States, Sweden, and the United Kingdom, where many of the plants are used for processing market milk. It is apparent also that plants used for the processing of butter and cheese and ice cream are also being built to provide the much improved sanitary conditions during operations.

Time and motion studies of dairy processing operations are being used as a basis for more efficient plant design. In many instances a complete schedule of all operations is charted for the purpose of assisting in the development of an efficient plant design.

Much attention is being given to proper location of the plant in order that raw materials may be easily and inexpensively brought to the plant and the finished product readily removed. Discussion brought out the fact that the location of a plant is often a limiting factor in its development and growth, due to bottlenecks which develop in transportation, water supply, sewage disposal or availability of power.

Much interest was shown in the multipurpose plant which, with relatively minor changes, may be used for the processing or manufacture of a number of dairy products.

The wing type of construction is favored for many plants on account of the ease of expansion and the amount of natural light available.

For plants which handle dusty products it has been found desirable to provide space for processing such materials in rooms not directly adjacent to fluid milk and the operations should therefore be segregated.

Considerable emphasis was placed upon the importance of the elimination of high humidity in dairy plants. High ceilings coupled with proper air ducts have been found helpful; however, modern forced circulation is most effective in preventing excessive humidity conditions.

Emphasis was placed upon modern sweet water cooling and the so-called ice maker type of sweet water cooling system was of note. These systems are favored because of their efficiency, lack of corrosion problems and adaptability to use with the plate type heat exchange equipment.

Modern milk plants are fitted with specialized cleaning equipment which is designed especially for saving labor. Short pipe lines,

elimination of fittings, and handy wash tanks are important. In Sweden, Denmark, Germany, and England many plants do not take down the sanitary pipe lines for washing except at long intervals. Special cleaning methods are used which are said to be commercially satisfactory.

A summary of some of the main considerations agreed upon by authorities from different countries is as follows:

1. The single floor plant is favored.
2. Small plants should have relatively few partitions and very little departmentalization.
3. A layout should be used which will require the minimum of sanitary pipe and fittings.
4. The plant should have a pleasing architectural appearance.
5. The pasteurizing and bottling room should be segregated by impervious walls from receiving rooms and other processing rooms.
6. All line shafting and as much piping as possible should be eliminated from the milk processing room.
7. Sufficient space (about 30 inches clearance) should be provided around all equipment so that it may be readily cleaned and serviced.
8. Plant design should provide for future expansion without excessive rebuilding or rearrangement.
9. The services of a qualified architect and experienced engineers should be obtained when designing a plant.
10. Great attention should be given to local, state, and national health regulations which may affect the design.
11. Plants manufacturing several dairy products in which there is danger of contamination from each other should departmentalize the operation and compartmentize the design.
12. A complete chart of daily operations should be made before designing the plant in order to properly proportion the different equipment and determine space requirements.
13. A time and motion analysis of operations will be found of assistance in deciding on details of construction and plant layout.
14. A plant must be so constructed that it can be easily and thoroughly cleaned.
15. The combination plant which can be used for manufacturing various types of products is favored for many localities from an economic standpoint as well as from the standpoint of providing a flexible operation capable of handling surpluses and special needs.

Comments, Section III (c), Subject 2

The three papers that were submitted for discussion under Subject 2, Construction of Dairies and Choice of Building Material, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. Y. Rosen, of Sweden, was the general reporter.

Prof. A. W. Farrall, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

CONSTRUCTION OF DAIRIES AND CHOICE OF BUILDING MATERIAL

Comments by A. W. Farrall, Head of the Department of Agricultural Engineering, Michigan State College, East Lansing, Michigan

Mr. Rosen states that the general type of structure for dairy buildings appears to be much the same in different countries from which papers for the Congress have been submitted. One-story construction of simple design is recommended or, at most, moderate and small size buildings.

Buildings should not be divided into an excessive number of small rooms; also, there should be a minimum of obstructions such as supporting posts in the workrooms.

Reinforced concrete is recommended for bearing inner structures.

Considerable importance is attached to the outside appearance of the building in order that it should give a good impression.

The height of the workroom varies in many countries; however, Sweden, by statute, requires that the ceiling height be at least 3.5 meters.

Floors for dairy plants should have so-called Klinker tiles at least 2 centimeters in thickness. Coating the joints of the tiles with fluorates will be beneficial and will bind the free lime in the mortar. The surface becomes harder and more resistant against acid. Manufacturers in Sweden are experimenting with the development of new and better joint compounds for use with tile.

Iron coatings or reinforcings are recommended for the floors in those places where the impact of milk cans and heavy loads is most severe.

Rosen states that the best water insulation of flooring in the dairy is the so-called membrane insulation. The membrane insulation is described as two layers of asphalt cardboard and three coatings with hot asphalt.

Several new heat insulating materials are now being used. One of these is a so-called porous concrete. Some progress is being made in lightweight brick also. Glass brick is also used with good results.

Cork is the standard insulating material. However, in Sweden a material called "Wellit" has been used with good effect. This insulation consists of a combination of cardboard and asphalt.

Comments, Section III (c), Subject 3

The seven papers that were submitted for discussion under Subject 3, Disposal of Dairy Waste Water, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. S. Vallin, of Sweden, was the general reporter.

Prof. A. W. Farrall, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

DISPOSAL OF DAIRY WASTE WATER

Comments by A. W. Farrall, Head of the Agricultural Engineering Department, Michigan State College, East Lansing, Michigan

Mr. Vallin emphasized the serious problem in all countries due to the lack of proper treatment of dairy wastes. Such conditions cause the death of fish, render the water unfit for cattle, and cause objectionable odors.

Mr. Vallin stressed the importance of prevention of milk losses in dairy plants through better plant practices.

Leakage of milk can, to a large extent, be prevented. Collecting vessels can be used to catch drainage from tanks, churns, and vats, and not be allowed to discharge into the waste water system.

Treatment of dairy waste waters in combination with city waste is preferred where possible. Where local treatment is required, high-rate, recirculating trickle filters probably have been most satisfactory.

Irrigation with the waste has been satisfactorily used where sandy soil is available. A new system known as the waste-pool or S. B. system is now being used in at least five dairies in Sweden. It is claimed that this new system is quite promising. The Dutch brush aeration and the English alternating double filtration system are mentioned as being effective but expensive. It is suggested that a well organized international exchange of results and ideas will be of great assistance in solving this important problem.

SECTION IV.--ECONOMICS AND TRADE

Forty-four papers were submitted for discussion under Section IV, Economics and Trade. The subject matter was presented under nine different subjects, as follows:

(a) Operational Economics.

Subjects 1 and 2.--Methods for Estimating Dairy Industrial Economy and Comparative Investigations of the Operational Costs for Dairies of Different Capacity.

Subject 3.--Labor-saving Methods in Dairies.

Subject 4.--Transportation Problems in the Dairy Industry.

(b) Trade.

Subject 1.--The Packing and Distribution of Milk for Human Consumption.

Subject 2.--The Food Value of Milk and Dairy Products for Human Consumption and Means for Increasing Their Consumption.

Subject 3.--Influence of Prices and Income (Purchasing Power) on the Consumption of Milk and Dairy Products.

(c) Standardization.

Subject 1.--Standardization of Composition (Quality) of Milk and Dairy Products.

Subject 2.--Packing of Milk and Dairy Products and Units of Measure for Sale.

Comments, Section IV (a), Subjects 1 and 2

The 11 papers that were submitted for discussion under Subjects 1 and 2, Methods for Estimating Dairy Industrial Economy and Comparative Investigations of the Operational Costs for Dairies of Different Capacity, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. P. Stallinga, of Holland, was the general reporter.

Dr. Ieland Spencer, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

METHODS FOR ESTIMATING DAIRY INDUSTRIAL ECONOMY AND COMPARATIVE INVESTIGATIONS OF THE OPERATIONAL COSTS FOR DAIRIES OF DIFFERENT CAPACITY

Comments by Leland Spencer, Professor of Marketing,
Cornell University, Ithaca, New York

The general reporter states that there is much advantage (for management purposes) in comparing operating data for a number of plants. He states that ordinarily this can be done only for plants that are essentially noncompetitive, otherwise the data are considered confidential. European countries have had little experience with comparative studies of business efficiency by the colleges or government agencies in which the confidential nature of the record used is preserved.

Mr. Stallinga mentions the difficulty of finding a simple measure that can be used to compare the efficiency of different plants. The prices paid for milk, even among cooperatives, are not a satisfactory basis of comparison since different policies may be followed as to charges for depreciation, and other non-cash items.

Hilding, an executive of the Swedish Dairies Association, recommends what he calls the "net milk value" as a basis for rating the efficiency of different dairies. In a paper prepared by two other staff members of the S. M. R., the operating costs of many dairies were analyzed by the process of sorting, subsorting, and cross-tabulation. The dairies were first grouped by type of operation, and then divided into subgroups according to the volume of milk received. For each group and subgroup, data are given as to the amounts of different classes of costs.

An unusually interesting paper was contributed by F. W. Charles of Great Britain, who has charge of the costing of milk distributing operations for the Ministry of Food. He gives a brief but informative review of significant changes in milk marketing in Great Britain, from the 1930's to the present, pointing out conditions such as rationalization of deliveries and other government regulations that influence costs. He makes the following statement, which in view of his intimate knowledge of the situation and his competence is of the greatest significance. "...it seems certain that the diminution of incentive to efficiency which tends to occur in regulated industry has reduced, if not entirely offset, any of the theoretical economies assumed to be obtainable by noncompetitive trading."

Comments, Section IV (a), Subject 3

The two papers that were submitted for discussion under Subject 3, Labor-Saving Methods in Dairies, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. F. Procter, of Great Britain, was the general reporter.

Mr. Don S. Anderson, who was an official delegate for the United States, has prepared the following summary of the papers, especially for this report.

LABOR-SAVING METHODS IN DAIRIES

Comments by Don S. Anderson, Production and Marketing Administration,
U. S. Department of Agriculture, Washington, D. C.

Two papers were submitted to the Congress on this subject--one from

France and one from Great Britain. Both papers stressed the need for more mechanization in the bottled milk industry. The paper from Great Britain said that further gains in that country would have to be accomplished in the processing of milk rather than in distribution. The reason for this is that rationalization of retail distribution during the war had already reached a high degree of efficiency.

There were two general reasons given for the need of finding more labor-saving methods. The one most emphasized was the business reason of the need for reducing costs in order to increase profits. The other reason was that of making the life of the worker more agreeable by eliminating, to the greatest possible degree, the need for working on Saturday and Sunday and by finding mechanical ways of doing the humdrum and backbreaking tasks of the business. By far the most stress was placed on the first of these two reasons.

One method of saving labor that was stressed was the use of automatic controls and regulations. This might be looked upon as much a control of quality as a method of saving labor.

The theme running through both papers was the need for greater mechanization in the bottled milk industry. This has a curious sound to one from the United States where we generally hear that European countries are relatively better supplied with human labor than with mechanical equipment and power. In explanation of this, the papers refer to high labor costs and therefore the need for more machines on account of the cost of social security, taxes, insurance against accidents, sick leave, paid vacations, the shorter work week, etc.

The emphasis in the papers would appear to spring from current economic and social developments in Europe. Even in this atmosphere, however, no thought was given to the possibility of even higher social security costs that might result if more mechanization resulted in more unemployment. The emphasis was on saving manpower by using more machines with only little thought as to what the saved manpower would be used for. Mention was made of higher wages to improve the quality of work--a few good men will do more than a large number of inferior workers.

The current shortage of milk in the countries from which the authors of the papers came probably made it easy for them to pass over the problem of who would drink the milk as machines more and more replaced men. This may explain why most of the emphasis on the need for mechanization was on the side of reducing costs rather than on the side of lessening human drudgery.

Comments, Section IV (a), Subject 4

The seven papers that were submitted for discussion under Subject 4, Transportation Problems in the Dairy Industry, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. H. Rautavaara, of Finland, was the general reporter.

Prof. A. W. Farrall, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

TRANSPORTATION PROBLEMS IN THE DAIRY INDUSTRY

Comments by A. W. Farrall, Head of the Agricultural Engineering Department, Michigan State College, East Lansing, Michigan

Mr. Rautavaara did not deliver his paper due to cancellation of the session; however, in his general paper he points out that within 25 years, milk transportation has changed in many localities from small-scale local haulage by horse to extensive long-distance motor transportation. He states that the general world-wide tendency is toward 10-gallon churns rather than the 17-gallon churns which were formerly used to a large extent.

Large consumers in large centers, particularly the U. S. A., Canada, and England, operate largely with tank trucks rather than churns or cans. Most of the tank trucks are now being made of stainless steel or aluminum. Good insulation is an important factor in the success of milk trucks.

Delivery of milk on retail routes is carried out largely by motor vehicles in the U. S. A., and horse-drawn equipment is still largely used throughout the rest of the world. Mr. Rautavaara outlines the main objectives of transportation procedure: (1) Adaptation of the transport to the time of day which is desired, (2) to adapt the transport to the standards of preservation of milk and dairy produce, (3) the reduction of transportation costs. Both Finnish and Swedish investigators have made special studies of the cost of transportation of farm milk routes. The United States has also made studies of this type.

Comments, Section IV (b), Subject 1

The four papers that were submitted for discussion under Subject 1, The Packing and Distribution of Milk for Human Consumption, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. K. L. Devriendt, of Belgium, was the general reporter.

Dr. Leland Spencer, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

THE PACKING AND DISTRIBUTION OF MILK FOR HUMAN CONSUMPTION

Comments by Leland Spencer, Professor of Marketing, Cornell University, Ithaca, New York

The general reporter reviewed four papers contributed by the following people:

Jean Pien - Laboratories of the S. A. F. R. Dairy France

Emile Vindal - Laboratory of the Cooperative Union Liege, Belgium

S. J. de Vries - General Manager
The Sierkan Dairy
The Hague, Holland

E. Capstick - Director
United Dairies, Ltd.
London, England.

The first two papers dealt mainly with technical aspects of milk packaging and distribution and will be passed over without further comment here. The other two papers as noted above were contributed by executives of companies engaged in milk distribution on a large scale. These men speak from a rich background of personal observation and experience. What they have to say is of so much interest and importance, at least to this reviewer, that he is basing most of his comments directly on the papers rather than upon the general report.

Comments, Section IV (b), Subject 2

The eight papers that were submitted for discussion under Subject 2, The Food Value of Milk and Dairy Products for Human Consumption and Means for Increasing Their Consumption, were summarized by Mrs. Ethel A. Martin, the general reporter for this subject. Mrs. Martin, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

THE FOOD VALUE OF MILK AND DAIRY PRODUCTS FOR HUMAN CONSUMPTION AND MEANS FOR INCREASING THEIR CONSUMPTION

Comments by Mrs. Ethel A. Martin, Director, Nutrition Service, National Dairy Council, Chicago, Illinois

The report explored the two phases of the subject, namely, the food values of the different dairy products and methods to increase consumption in amounts recommended by scientific authorities. Papers from several different countries and two from the United States were used in preparing the report.

The present known facts about the nutritive contributions of proteins, fats, carbohydrates, minerals, and vitamins in dairy products were treated in some detail, with supporting tabular data. In addition, nutrition research now in progress on each of the products was outlined briefly.

Statements were cited to prove that no other food exceeds milk in the possibilities it holds for the improvement of human life through better nutritional well-being. The program of the National Dairy Council, U. S. A., was used as an example of an industry-supported effort to increase consumption of all dairy products. The general plan of work of the organization and the media used were described. Suggestions made by authors from other countries for raising the level of milk consumption throughout the world were given full consideration.

Five persons whose papers contributed to the report were present when it was read and entered into the discussion. For the most part they amplified their original papers with information available since the papers were submitted.

Briefly the contributions made were as follows: Dr. W. E. Krauss,

Ohio Agricultural Experiment Station, Wooster, added the information that research by Dr. Ancel Keys of the University of Minnesota shows that the cholesterol content of the diet does not affect the cholesterol level of the blood. High blood cholesterol is associated with certain types of heart disease. The Keys findings therefore remove any question of the possible harmfulness of dairy products due to cholesterol content.

Prof. Torsten Pehrson, University of Stockholm, Sweden, described the Milk Propaganda Organization of Sweden at the request of the general reporter. The information given is contained in a paper by Gösta Callert, under Section IV (b), Subject 2, which was received too late to be included in the general report.

Agricultural Engineer MaRinus de Vos, The Hague, Netherlands, urged again the point made in his paper, i.e., that the International Dairy Federation study in a small international committee the matter of educational procedures, in the interest of increased consumption of dairy products for all countries.

Dr. H. E. Magee, Ministry of Health, Whitehall, London, England, reported current favorable growth rates of English children, as an addition to data included in his paper.

Mrs. E. A. Martin modified the portion of her paper and general report regarding the "X-factor" in milk. Since this material was submitted, the U. S. Bureau of Dairy Industry has shown that the "X-factor" is identical with the new vitamin B_{12}.

Comments, Section IV (b), Subject 3

The three papers that were submitted for discussion under Subject 3, Influence of Prices and Income (Purchasing Power) on the Consumption of Milk and Dairy Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. Dr. Leland Spencer, an official delegate for the United States, was the general reporter.

INFLUENCE OF PRICES AND INCOME (PURCHASING POWER) ON THE CONSUMPTION OF MILK AND DAIRY PRODUCTS

Comments by Leland Spencer, Professor of Marketing,
Cornell University, Ithaca, New York

The evidence supplied by the papers reviewed in this report and other sources shows that consumer incomes and retail prices have a major influence upon the rates of consumption of milk and its products. This is true whether we consider differences in consumption rates among population groups at a particular time, or changes in these rates from one time to another.

However, when it comes to precise measurement of relationships between income and price and the consumption rates for milk, butter, cheese and the like there appears to be much disparity in the findings of various studies. In general, there is agreement that the demand for fluid milk and evaporated milk is relatively inelastic, and that the consumption of such semi-luxuries as cream and ice cream responds in much greater degree to differences or changes in income and price. But when we look for more refined measurements such as regression coefficients or coefficients of elasticity for the several products we find

that numerous studies have yielded a rather wide range of answers. For example, some investigators have reported practically no response of milk consumption to changes in income or price, while others have found elasticity coefficients ranging from .5 to 1.3 or even higher.

Mork has suggested that the lack of agreement in results of different attempts to measure these relationships may be due to imperfections in the methods of analysis or to errors in the data used. A third possibility is that the relationships are not the same under all conditions. Perhaps a useful purpose will be served by listing here in some detail probable reasons for the uneven results of various efforts to measure the relationships of income and price to the consumption of milk and its products.

In the first place, as we survey the various studies of these relationships, it is obvious that a wide range of choice has been exercised as to the types of data selected as well as in the methods of analysis. The following are important examples:

1. Family income vs. per capita income and family consumption vs. per capita consumption.
2. Income vs. food expenditure or some other measure of the level of living.
3. Quantities of the specified products consumed vs. amounts spent by consumers for these products.
4. Definition of product--e.g., fluid milk alone vs. fluid milk and cream as milk equivalent, or fluid (whole) milk together with buttermilk, skim milk, chocolate drink, etc.
5. Home consumption vs. total consumption.
6. Analysis of differences between families or other population groups vs. analysis of changes over time.
7. Differences in analytical procedure--e.g., regression analysis vs. tabular analysis, adjustment or nonadjustment of income and price for changes in price level or cost of living, etc.

Most of these differences in types of data and methods of analysis have been mentioned in summarizing the several papers and do not require further discussion here. Usually there have been good reasons for the choices made by the investigators. Nevertheless the nature of the data and the methods of analysis should be clearly indicated since they have an important bearing on the findings reported.

Much of the disagreement in the results of attempted measurements of income-consumption and price-consumption relationships can be traced to the use of inadequate or inaccurate data in many of the studies. Probably the most common fault in studies of consumption differences among groups of families has been the failure to obtain adequate data for families near the lower end of the income scale. It is clear that greater elasticity of consumption exists at the lower levels of income. Studies in which these groups are not properly represented therefore show less elasticity than is characteristic of the population as a whole. This has been true of certain studies in the United States which involved analysis of milk consumption among families supplied by retail routes, in markets where the majority of low-income families purchased their milk at stores.

It is not uncommon for those in charge of consumer surveys to attempt to build up the study sample in such a way as to give proportional representation to the various income classes and other groups in the area. This often results in obtaining so few records for families with very low incomes that desirable subsorts are not possible. Consumer

surveys are much more effective for the purpose of revealing differences among families and population groups than for determining average rates of consumption for a market or other area. This being true, consideration might well be given to including in the study sample approximately equal numbers of families in the several income classes.

Another important source of differences in results shown by studies in this field is the failure in many instances to eliminate or allow for the influence of factors that are interrelated with income or price and the consumption of milk and its products. This problem was stressed in the paper prepared by Clark. A good illustration of this is found in a number of consumption surveys in the U. S. A. that have included substantial numbers of negro families. It happens that negroes as a group are sparing users of fluid milk even when their incomes permit a relatively free choice of foods. The fact that in the studies mentioned disproportionate numbers of negro families have been included in the lower income classes without segregation has resulted in overstatement of the influence of income on the consumption of milk.

Again, some geographically extensive surveys of consumer purchases or diets have resulted in reported measurements of income-consumption relationships without consideration of important interrelated factors such as retail prices, climate, place or mode of living, and quality of milk available. In the Southern States of the U. S. A., for example, consumer incomes are relatively low, the retail price of milk is relatively high and the quality of milk in general is not as high as that in the North. Southern food habits also are influenced by the warm climate and by the kinds of good crops most easily grown there. If income and consumption data for that region are combined with similar data for other parts of the country, obviously any measurement of the influence of income upon the purchases or consumption of milk will be distorted and unreliable.

Finally, we must not overlook the possibility that data used in various studies of the relationship of income and price to the consumption of milk and its products may not be entirely accurate.

With respect to data obtained in consumer surveys there is the well-known difficulty of obtaining satisfactory information about family incomes as well as the tendency of housewives to overstate the quantities of milk purchased. In certain studies where the reported purchases from milk distributors have been compared with the recorded sales by distributors to the same families a disparity of 10 to 15 percent was shown. This was not particularly disturbing until one investigator reported a finding that high-income families tend to overstate their milk purchases more than medium- or low-income families do. (Money Illusion and Demand Analysis by Marshak, in Review of Economic Statistics, February 1943.) To the extent that this is true, consumer survey studies generally show more income elasticity of demand for milk than really exists.

Then with regard to time series of income, price and consumption data the possibilities of error are considerable. It is only in quite recent years that methods of estimating national income or consumer income in the various countries have been developed to the point of assured reliability. In the United States and probably in other countries any single consumer price quoted for milk, butter, cheese and so on is likely to fall short by far of representing the cost of milk to different families or groups in the population. In many instances, there is actually a range of prices depending upon quality, grade or brand, quantity purchased, type of package and type of service. Sometimes black market prices or gratuities are involved.

In few instances do we have consumption data for milk and other products extending over time that are wholly dependable. In the United States, national figures for consumption of fluid milk and cream (in terms of milk equivalent) are obtained by subtracting the sum of estimated quantities retained on farms and the computed milk equivalent of products manufactured in dairy plants from the estimated total milk production. Separate figures for milk consumed as such are available only for certain markets, not for the country as a whole. The consumption of butter, cheese, canned milk and powdered milk is calculated by adjusting the reported factory production (plus estimated farm production in the case of butter) for imports and exports, and for changes in storage holdings from one year-end to the next.

No one can say just how large is the margin of error in these estimates. Considering the many difficulties involved, as well as the diligent efforts of government statisticians and cooperating agencies, it seems that the probable error in most of the estimates should not exceed about 5 percent. Even this margin of error is considerable and it is obviously unwise to attach significance to slight differences in determinations based on such data.

Comments, Section IV (c), Subject 1

The seven papers that were submitted for discussion under Subject 1, Standardization of Composition (Quality) of Milk and Dairy Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. O. F. König, of Switzerland, was the general reporter.

Dr. H. H. Sommer, who was an official delegate for the United States, has listed the titles of six of the seven papers, especially for this report.

1. Legal Standards for Milk and Milk Products in France.
2. Standardizing the Fat Content of Milk for Cheesemaking (Norway).
3. Legal Standards for Processed Cheese and Cheese Spreads or Cheese Food Compounds in Germany.
4. Standardizing the Fat Content of Consumer Milk (Austria).
5. Top Grade Butter, "Floralp," as Established by Regulations and Grading in Switzerland.
6. Standardization of Consumer Milk in Sweden.

Comments, Section IV (c), Subject 2

The two papers that were submitted for discussion under Subject 2, Packing of Milk and Dairy Products and Units of Measure for Sale, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. J. P. Blondot, of France, was the general reporter.

Mr. Don S. Anderson, who was an official delegate for the United States, has prepared the following summary of the papers, especially for this report.

PACKING OF MILK AND DAIRY PRODUCTS AND UNITS OF MEASURE FOR SALE

Comments by Don S. Anderson, Production and Marketing Administration, U. S. Department of Agriculture, Washington, D. C.

Two questions are discussed in the two papers submitted under this title. Both are difficult for a representative of the United States to understand because of the great difference between the situation in the United States and Europe with respect to the problems discussed.

The first problem arises from the relative smallness of European countries in area and population as compared with the United States. The author points out that each country may obligate its members to use its official scale of sale-units. Thus, if many countries are too small to support an efficient industry for the production of implements used for the packaging of milk and dairy products, this multiplicity in the size of sale-units creates a problem. As mechanization increases the problem increases, especially when the industry for making the equipment is located in one country and should be in a position to supply machines for packing dairy products in a number of countries.

This leads the author to conclude that "the interest of all therefore is to seek the unification of containers which will bring with it the unification of materials, and we are thus brought to face the problems of international standardization."

Because of the large size of the United States this problem is much less important for us.

The bulk of the paper gives details as to the characteristics of sizes of and materials used in packages for fresh milk, butter, and cheese in France.

SECTION V.--ORGANIZATION OF THE DAIRY INDUSTRY

Thirty-two papers were submitted for discussion under Section V, Organization of the Dairy Industry. The subject matter was presented under two different subjects, as follows:

Subject 1.--The Organization, Structure, and Economic Position of the Dairy Industry in Different Countries.
Subject 2.--Governmental Action to Foster the Development of the Dairy Industry and to Improve the Quality of Dairy Products.

Comments, Section V, Subject 1

The 20 papers that were submitted for discussion under Subject 1, The Organization, Structure, and Economic Position of the Dairy Industry in Different Countries, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. J. Linthorst-Homan, of Holland, was the general reporter.

Dr. Sherman E. Johnson, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

THE ORGANIZATION, STRUCTURE, AND ECONOMIC POSITION OF THE DAIRY INDUSTRY IN DIFFERENT COUNTRIES

Comments by Sherman E. Johnson, Assistant Chief,
Bureau of Agricultural Economics,
U. S. Department of Agriculture, Washington, D. C.

The discussion was opened by Dr. J. Linthorst-Homan of Holland, who was the general reporter for this session. His remarks were supplemented by Richard Allman, Food and Agriculture Organization, and by Prof. Rasmus Mork, of Norway.

Discussion centered on the three segments included in the above title.

Organization

The discussion on organization of the dairy industry recognized the extreme diversity of conditions under which dairying is carried on in different parts of the world. No attempt was made to generalize concerning conditions most favorable for dairy production. Mr. Allman reported that FAO was making a world dairy survey with emphasis on increasing dairy production in areas where dairying is now of minor importance. He emphasized their desire to cooperate with the International Dairy Federation on specific projects in this undertaking. Dr. Linthorst-Homan emphasized the desirability of developing in each country organizations of dairy producers which have close affiliations with professional farm organizations; also the need for including dairy problems in the considerations of general farm organizations. He recommended that the central working group in each country which represented the dairy industry work with professional farm organizations, labor organizations, and government officials to promote dairying and a better understanding of dairy problems. He also emphasized the need for close cooperation among the International Dairy Federation, the International Federation of Agricultural Producers, and the Food and Agriculture Organization. Because of the growing importance of economic problems in both national and international aspects of the dairy industry, he suggested more emphasis on economic problems in the International Dairy Federation.

Structure

Emphasis was placed on the need for modernization and rationalization of dairy production at the farm and of factory processing. The recommendation was made that insofar as possible milk should be brought to factories for processing. An exception was made of milk for production of special farm cheeses. It was also emphasized that processing should be specialized as far as possible and the processing plant should be large enough for economic operation.

Economic Position

It was emphasized that progress of the dairy industry involves not only technical and economic questions, but that it is also intimately associated with national welfare, both from the standpoint of nutrition and of maintenance of food production. Mention was made of the

competition between margarine and butter and that suggestions had been made for joint study of this problem among the International Federation of Agricultural Producers, the Food and Agriculture Organization, and the International Dairy Federation.

There was some discussion of ways of increasing consumption of dairy products. This discussion emphasized the importance of advertising and propaganda. The development of the avocado industry in California was cited as an illustration of the effectiveness of advertising.

Comments, Section V, Subject 2

The 12 papers that were submitted for discussion under Subject 2, Governmental Action to Foster the Development of the Dairy Industry and to Improve the Quality of Dairy Products, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. J. Sundby, of Norway, was the general reporter.

Mr. Don S. Anderson, who was an official delegate for the United States, has prepared the following summary of the more pertinent papers, especially for this report.

GOVERNMENTAL ACTION TO FOSTER THE DEVELOPMENT OF THE DAIRY INDUSTRY AND TO IMPROVE THE QUALITY OF DAIRY PRODUCTS

Comments by Don S. Anderson, Production and Marketing Administration, U. S. Department of Agriculture, Washington, D. C.

Twelve papers were submitted under this title. From these 12 papers and from other sources the general reporter has listed 12 ways in which governments have interested themselves in the dairy industry. These are:

1. Training and Education of Dairy Employees.
2. Instructional Work.
3. Quality Work and Quality Control.
4. Experimental Work.
5. Combating of Infectious Cattle Diseases.
6. Breeding.
7. Credit.
8. The Margarine Legislation in Various Countries.
9. Other Measures for the Regulating of Prices and Sales During the Years Between the Two World Wars.
10. The States' Attitude to the Dairy Industry during Second World War.
11. The Postwar Period.
12. Standardization of the Fat Content of Market Milk.

As measured by the time devoted to them, the general reporter ranked two of the twelve as of outstanding importance--"Quality Work and Quality Control" and "Other Measures for the Regulation of Prices and Sales During the Years Between the Two World Wars." Next in rank with about half as much time devoted to each are "Instructional Work" and "Standardization of the Fat Content of Market Milk."

The discussion following the paper of the general reporter turned to different subjects. Most of the discussion referred to margarine legislation. The allegation was made from the floor that margarine was hygienic, well-flavored and cheap, and the attitude taken from 1930 to

1940 against this product should not be taken.

To this the reply was given that not only the question of nutrition but also of health should be considered and preference should be given to butter. It was argued that "we live in a directed economy" and therefore must have "regulation" of margarine as of other items.

Quality work and quality control have been carried out most intensively in exporting countries. Especially for butter, a number of them established a "brand" for which higher than normal quality standards are established. The problem of marking so as to carry through to the consumer has retarded this development for cheese.

The principal features of the measures taken by the various countries between the two World Wars were those designed to make home prices for milk and milk products independent of world market prices. Perhaps the steps that would seem most unique to an agricultural economist from the United States were those taken by Sweden to reduce "the tension between the production milk and the market milk so that the price of the latter could gradually be raised from its low level."

SECTION VI.--TROPICAL DAIRYING

Fourteen papers were submitted for discussion under Section VI, Tropical Dairying. The subject matter was presented under four different subjects, as follows:

Subject 1.--The Influence on the Efficiency of Milk Production in the Tropics of the Introduction of New Breeds of Dairy Cattle, the Improvement of Fodder Supplies and Other Measures.
Subject 2.--Manufacture of Butter, Cheese, and Other Dairy Products under Tropical Conditions.
Subject 3.--Milk Supply in the Large Tropical Towns.
Subject 4.--The Efficient Storage of Dairy Products in the Tropics. (No papers were presented on this subject.)

Comments, Section VI, Subject 1

The 10 papers that were submitted for discussion under Subject 1, The Influence on the Efficiency of Milk Production in the Tropics of the Introduction of New Breeds of Dairy Cattle, the Improvement of Fodder Supplies and Other Measures, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates.

Dr. O. E. Reed, an official delegate for the United States and chairman of the U. S. delegation, was the general reporter.

THE INFLUENCE ON THE EFFICIENCY OF MILK PRODUCTION IN THE TROPICS OF THE INTRODUCTION OF NEW BREEDS OF DAIRY CATTLE, THE IMPROVEMENT OF FODDER SUPPLIES AND OTHER MEASURES

Comments by O. E. Reed, Chief of the Bureau of Dairy Industry, United States Department of Agriculture, Washington, D. C.

The following papers dealing with Subject 1, Section VI, were submitted:

1. Reed, O. E. "The Progress in Crossbreeding with Dairy Cattle of Indian Origin."
2. Feunteun, M. L. M. "Milk Production, Introduction of Better Breeds, and Nutrition of Cattle in French Territories under Tropical Climate."
3. Miller, Wm. C. "The Inefficiency of Dairy Cattle in Tropical Countries--An Analysis of the Problems."
4. Seath, D. M. "Adding to the Comfort and Increasing the Feed Consumption of Cows during Summer Months."
5. Geurden, L. "Milk Supply in Belgian Congo."
6. Perry, E. J. "Improvement of Milk and Butterfat Production by Organized Artificial Insemination."
7. Baltzer, A. C. "Organization and Development of Artificial Insemination of Dairy Cattle in Michigan."
8. Fohrman, M. H. "Some Results of Research on Dairy Cattle Breeding in the Bureau of Dairy Industry, U. S. D. A."
9. Kendrick, J. F. "Proved Sires in the United States."
10. Kendrick, J. F. "Dairy Cattle Artificial Breeding Cooperatives in the United States."

Reed gave a brief review of research now under way in which Red Sindhi cattle imported from India are being crossed with Jersey cattle in the Bureau of Dairy Industry of the United States Department of Agriculture in an attempt to develop a heat-resistant cattle in tropical and subtropical areas. Feunteun reports numerous experiments in crossing of native cattle with imported European cattle. Feunteun and Miller discuss the need for increasing milk production in their countries and stress the need for greater efficiency.

Seath reviewed experiments that were carried on by him and his associates at the State experiment stations in Kentucky and Louisiana covering several years' work on the effect of temperature on comfort of cows and also in relation to effect of temperatures on milk production. He obtained good results by spraying cows with water and by cooling by use of fans.

Geurden reported that several attempts had been made to develop better-producing cattle in the Belgian Congo by crossing the native breeds with well-known English and European dairy breeds. Crosses with Friesian cattle gave the best results. Perry of New Jersey states that the use of proved sires in artificial insemination resulted in higher production of daughters over their dams. He states that the first 580 artificially inseminated daughters produced an average of 424 pounds of butterfat as compared with the production of 399 pounds of butterfat by their dams in a 10 months' lactation.

Baltzer described the methods of organization of the Michigan Artificial Breeding Association. The program was started in 1943 and by 1949 more than 120,700 cows were served during the year. He emphasized the importance of good organization and well-trained technicians.

Fohrman gave results of breeding investigations with dairy cattle conducted by the Bureau of Dairy Industry of the United States Department of Agriculture during the past 30 years. In this 30-year experiment the average production of the herds of Holstein and Jersey cattle was increased by 200 pounds of butterfat per year through the continued use of proved sires. He also cited results obtained by crossbreeding of the pure strains or breeds of dairy cattle through use of proved sires.

Kendrick discussed the proving of dairy sires through dairy herd improvement associations. A program begun in 1935 has resulted in

proving of more than 25,000 dairy sires in farmers' herds in the U. S. A. In his second paper Kendrick discussed the details of the organization of artificial insemination in the United States. In the first association organized, one sire on the average was required to serve 228 cows, and in 1948 each bull in use served 999 cows.

Comments, Section VI, Subject 2

The two papers that were submitted for discussion under Subject 2, Manufacture of Butter, Cheese, and Other Dairy Products under Tropical Conditions, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. N. K. Bhargava, of India, was the general reporter.

Dr. G. M. Trout, who was an official delegate for the United States, has prepared the following summary of the papers, especially for this report.

MANUFACTURE OF BUTTER, CHEESE, AND OTHER DAIRY PRODUCTS UNDER TROPICAL CONDITIONS

Comments by G. M. Trout, Professor of Dairy Manufactures, Michigan State College, East Lansing, Michigan

There are many varieties of soft cheese in Egypt, but two (Domiate and Kareish) are the most popular. The first is a rennet-type cheese in which milk is salted with a high percentage of salt (5-15 percent) prior to renneting. The second is an acid-type curd cheese in which salting is practiced after drainage. Both types are pickled and contain a relatively high percentage of sale (4-8 percent).

Clarified butter (Ghee or Samneh), Khoa (in India), and soft cheese (in Egypt, Morocco, Algeria, and Tunis) are the three main dairy products of the tropics. Clarified butter (Ghee or Samneh) represents an almost ideal method of preservation of most of the desirable qualities of milk fat, under the prevailing climatic, economic, and insanitary conditions. A well-made clarified butter--in which the absence of moisture, protein, and lactose almost entirely eliminates microbiological activity--can be kept unspoiled for long periods, and this accounts for its popularity in tropical countries. The manufacture of clarified butter is essentially a cottage industry which helps the farmer to eke out his agricultural income to a small degree.

A great deal of research work on Ghee has been carried out in India to study its keeping quality, nutritive value, and vitamin value, and to devise good methods of manufacture. The Indian government has taken steps in the right direction by enforcing a Marketing Act which requires all produce to be graded and certified by government (or government-approved) laboratories before sale. Certain quality standards have been laid down (e.g., for acidity, moisture content, and saponification, Reichert-Meissl and Polenske values), together with specifications for containers. This is helping the industry to become established on a sound basis.

Khoa (India): This is the most important of the unfermented milk products. Small quantities of milk (usually about 2.5 kg.) are evaporated in a round-bottomed, shallow iron pan (Khari) over a fairly hot and steady fire. To prevent scorching, the milk is continuously stirred with a special scraper (Khumti); with the diminution of volume the rate

of stirring is increased and the operator has to exercise skill in maintaining a uniform consistency in the mass. After about 15 minutes, the mass assumes a pasty consistency; the pan is then removed from the fire and the product is well worked with the flattened end of the scraper by alternately spreading into thin layers and collecting together again until the mass can retain its own shape. At first the mass has the consistency of butter, but after cooling it becomes more solid and dough-like. It is now shaped into large circular pats and allowed to cool on the floor. It has a wholesome lightly cooked, sweet flavor.

Khoa is used mainly in the preparation of sweetmeats. The keeping quality of the milk is preserved by its conversion into semisolid form, the heating and the concentration of milk constituents both tending to eliminate bacterial growth. Khoa keeps well for 4-5 days in cool weather and 2-3 days in hot weather, and by the addition of sugar may be prolonged to 3 or 4 months.

Western dairy products, like butter and hard cheese, are unlikely to find a major place in the tropics and it is suggested that intensive investigation should be made of present indigenous products. The methods of manufacture may be capable of improvement to secure more uniform quality and reduce wastage.

Due to scarcity of milk and its scattered production, it is difficult to collect a large quantity at a central place for manufacture on a factory basis. It is suggested that a village factory system should be tried, which is quite different from the large factory system.

The present system is uneconomical and wasteful, and produces a product of variable quality. There is also a great need for the development of improved breeds of cattle and hygienic methods of production and handling of milk which will eventually lead to better quality products.

Comments, Section VI, Subject 3

The two papers that were submitted for discussion under Subject 3, Milk Supply in the Large Tropical Towns, were summarized by a general reporter for the Congress, and his paper was the only one read to the assembled delegates. E. Lancelot, of France, was the general reporter.

Dr. W. E. Krauss, who was an official delegate for the United States, has prepared the following summary of the papers, especially for this report.

MILK SUPPLY IN THE LARGE TROPICAL TOWNS

Comments by W. E. Krauss, Associate Director of the Ohio Agricultural Experiment Station, Wooster, Ohio

This report was of interest from the standpoint of supplementing the supply of fresh milk in countries where the mixture of natives and Europeans, and the existence of nomadic as well as confined herds, offered special problems.

Concentrated or dried milks were not regarded with much favor, owing to their cost and failure to guarantee imports in case of financial restrictions or international conflicts. At best these could be looked upon as sources of supply for children or the sick. Development of a "cooling line," refusal to permit the producer (because of lack of hygiene) to distribute to the consumer, and use of reconstituted milk

depots are suggested as measures worthy of consideration. Two significant conclusions are drawn:

1. At the milk production stage, milch herds should be established and a cooperator-producer organization created.
2. Specialists should be entrusted with all handling operations, including the actual milking and distribution from the milking to the consuming stages.

An Annex of Special Papers by American Delegates Follows.

THE DAIRY INDUSTRY IN SWEDEN

Sherman E. Johnson, Assistant Chief, Bureau of Agricultural Economics,
U. S. Department of Agriculture

The Mainstay of Swedish Agriculture

The dairy enterprise is by far the most important source of income for Swedish farmers. In recent years milk and dairy products have furnished 40-45 percent of the total farm income. Beef and veal are largely by-products of the dairy enterprise in Sweden; and these have provided another 10 percent of the total farm income. The income from all livestock and livestock products, including poultry and eggs, accounts for about 75 percent of the total farm income. (1)

The dominance of the dairy enterprise is most pronounced in northern Sweden where farmers are largely dependent on forage crops and pasture which are utilized by dairy cattle. More diversification is possible in central and southern Sweden. Wheat, oil crops, sugar beets, and some other enterprises are partial alternatives to dairying in these areas. The smaller farms tend to be more dependent upon the income from the dairy enterprise than the larger farms. (2) The reasons why dairying is so dominant in Swedish agriculture can be outlined more clearly by giving some attention to the agricultural resources and to the economy as a whole.

Swedish Agricultural Resources

In the following short description of Swedish agricultural resources several comparisons are made with Minnesota and adjacent States. The physical features of the landscape in the agricultural areas of northern Sweden are somewhat similar to the northern cut-over areas of Minnesota. The more level southern fringe of the Minnesota cut-over area might be compared with the Swedish central plain. And the physical conditions in the southern tip of Sweden and along the southwestern coast are also somewhat similar to southeastern Minnesota.

The effect of Sweden's far northern location is tempered by the influence of the gulf stream. It has a marine rather than a continental climate, which means less variation in temperature than in Minnesota. It has a cooler growing season, and a different distribution of rainfall. The annual rainfall in the agricultural areas varies from 15-25 inches, with much of it concentrated in the last six months of the calendar year. With low evaporation this amount of rainfall is usually adequate, although droughts are experienced in the early part of the growing season, and summer rains interfere with hay curing and grain harvest.

The total land area of Sweden is 103 million acres, or roughly twice as large as Minnesota. But only about 9 million acres are classed as cropland. Another 2½ million acres are in natural meadow. Thus, about 11.5 million acres, or 11.6 percent of the total land area, is used for crop and pasture production. This is about half of the total cropland area in Minnesota. About 55 percent of the land in Sweden is still in natural forest. The remaining one-third of the total land area is largely mountain areas above the forest limit, marshes, and other types of wasteland. (3)

The most productive cropland, and in fact a large percentage of the agriculture of Sweden, is found in the southern tip of the country and

along the southwestern coast. Here both soil and climatic conditions are most favorable for crop production. The vegetation period (from spring sowing to the beginning of the potato harvest) averages 140 days in this area. In northwest Norrland it is less than 100 days. Another important farming area is located in central Sweden. There are many smaller areas of concentrated agricultural production that are interspersed with forest and wasteland.

Sweden reports a total of 414,000 farms. This is about 7 percent of the 5.9 million reported for the United States in the 1945 census. But it is over twice as many farms as were reported for Minnesota in 1945. When we recall that Sweden has about half as much cultivated land as Minnesota it is evident that many of the farms are small. In fact, over one-fourth of the farms have less than 5 acres of cultivated land, and over three-fourths have less than 25 acres. One estimate indicates, however, that about 40 percent of the total number of farms can be classified as part-time farms or rural homes. Presumably the families on these units would have some other source of income. But another 20 percent are small holdings that constitute about the only source of income for the farm family even though they are too small to furnish an adequate living. (4)

Owner-operatorship is the prevailing mode of land tenure in Sweden, although about one-fifth of the farms are operated by tenants. The tenant farms average somewhat larger than the owner farms, and about one-fourth of the cultivated land is tenant-operated.

Dairying Furnishes Market for Forage and Family Labor

With 77 percent of the farms having less than 25 acres of cultivated land, one can readily understand why Swedish farmers have sought to intensify production on the area available for crops and pasture. If one also considers that much of the crop and pasture land is physically better suited for forage than for other uses, the reason for the relative emphasis on dairying is brought out more clearly. The dairy enterprise provides a market for forage and pasture that otherwise would not be marketable.

Nearly half of the crop and pasture land is now utilized for forage and pasture. The land area devoted to these uses has increased 22 percent since 1921-25. Horses, goats, and sheep have decreased in number during this period. Consequently, the dairy enterprise has apparently utilized not only the increase in forage production, but also the feed production released as a result of decreasing numbers of other forage-consuming animals. (5)

In addition to providing a market for forage and pasture, dairying is a source of employment for farm people. On farms that are large enough to utilize efficiently the labor of a farm operator and his family the work on a dairy farm is likely to provide productive work for most of the year. Even on the part-time farm dairying supplements fairly well such other employment as winter work in the forests.

The Market for Dairy Products

In order for dairying to furnish a market for forage and for farm labor the products of the dairy enterprise must in turn have a satisfactory market outlet. In the 1930's from 25-30 percent of the total

manufacture of butter was exported, largely to Britain and Germany. These markets disappeared at the beginning of the war, and at present nearly all of the dairy products are consumed within the country. Exportable surpluses of butter and cheese developed in 1949, partly because of favorable growing conditions. Some butter and a small quantity of cheese was exported, but difficulty was experienced in locating foreign outlets.

The total population of Sweden is about 6.9 million. This is roughly comparable to the population in the States of Minnesota, Wisconsin, North Dakota, and South Dakota. A market of that size in this country would not provide sufficient outlet for the quantity of milk that is now produced in Sweden. However, milk consumption per capita is much higher in Sweden than in this country. The estimated total milk production in 1947 was about 9 million pounds. After allowing for the whole milk used for stock feeding the apparent total milk consumption per capita was from 1,350 to 1,400 pounds. Apparent milk equivalent consumption of fluid milk and cream was 550 to 600 pounds. The 1947 consumption in this country was 794 pounds for all uses and 398 pounds milk equivalent of fluid milk and cream.

Nearly half of the total quantity of milk produced in Sweden in 1947 was utilized for making butter, but about one-fourth of the skim milk and buttermilk was processed for human consumption. Part of the skim milk was used for standardizing to 3 percent butterfat the milk sold for fluid use. (5) Butter consumption is about 10 pounds per capita higher than before World War II. This is partly accounted for by exchange regulations concerning imports of other fats and oils.

Dairy farmers of Sweden participate actively in developing and maintaining the market for dairy products. Local cooperative associations for the processing and marketing of milk have a history extending back to about 1890, but the depression of the 1930's furnished the impetus for federation of local creameries and their merging into a Nation-wide milk cooperative--Svenska Mejeriernas Riksforening (SMR). This organization now handles 97 percent of the total milk supply. (5)

SMR has managed to hold distributive margins on milk to fairly low levels. For example, in Stockholm during the summer of 1949 the price per liter (about one quart) for bottled milk was 36 ore. That would be about 7 cents per quart at present rates of exchange for milk of 3 percent fat content bought at dairy stores. Farmers received about 22.5 ore, or 4.3 cents per quart for 3 percent standardized milk. Thus, the total distributive margin was about 38 percent of the retail price. The relatively low prices for fluid milk undoubtedly are one factor in the high per capita milk consumption.

Although dietary habits are considerably different in Sweden than in this country it is evident that a high level of living and of food consumption also are necessary to maintain so high a per capita consumption of fluid milk and of other dairy products. The domestic market for dairy products has grown with the industrial development of the country, which has been accompanied by increases in national income and more widely distributed consumer purchasing power.

Timber, iron ore, and water power for electricity are the bases for industrialization in Sweden. Although much wood pulp and iron ore are exported, large woodworking and metal industries have been developed within the country. These, together with shipbuilding, shipping and electrical equipment, are the primary bases for industrial employment. The weakest link in the industrial structure is shortage of coal. (6)

In the years prior to World War II Sweden's industrial and world trade position was relatively strong. The postwar situation is also

strong in comparison with other western European countries. The country was relatively untouched by the war. Therefore, it has not experienced the problems of rehabilitation and reconstruction which have faced some other countries.

Despite this relatively favorable position among western European countries, Sweden has found need for exchange controls to protect her dollar exchange. This has resulted in pressure for self-sufficiency, which in agriculture has taken the form of subsidizing production of oil crops, food grains, and sugar beets. It has also meant higher per capita consumption of butter, as already indicated.

In the summer of 1949 the price protections on cash crops had resulted in some disadvantage to the dairy enterprise. There was considerable feeling among farmers that the price received for milk was too low in relation to the price of oil crops and food grains. If Sweden's trading position improves sufficiently to relinquish exchange controls it seems likely that the price pressure on milk from competing products will be relaxed. If the pressure were continued there might be a small shrinkage of the dairy enterprise, but its dominant position in Swedish agriculture would not be altered greatly. The great majority of Swedish farmers would lower their net incomes if they dropped the dairy enterprise, or even if they reduced it considerably. (2)

The agricultural legislation passed by Parliament in 1947 and somewhat modified since that time provides considerable protection and aid to Swedish farmers within their own national economy. Because the dairy enterprise is so dominant in Swedish agriculture it becomes the major factor in such protection. Most farmers who produce other products also produce milk.

Two major policy principles are outlined in recent legislation. One is a goal of 92 percent self-sufficiency in agricultural production. This grows out of the Swedish experience in the two world wars when they were largely dependent on their own food supplies. The other goal is income opportunity in agriculture comparable with other occupational groups. Because Sweden is a net importer of agricultural products, it is possible through price regulation, indirect subsidies, and exchange controls to establish prices for different farm products that will tend to achieve these two objectives.

The measure to be used for ascertaining achievement of the goal of income opportunity comparable with other groups is the income realized on efficiently operated "basic farms." These are farms which have 25 to 50 acres of cultivated land. Because so many Swedish farms are smaller than "basic farms," provision is made for subsidy payments on farms of smaller size when the family does not have outside employment. This subsidy is paid on the basis of the quantity of milk delivered, but the maximum limit is 480 crowns per year, $92 at the present rate of exchange. In some instances a special cash allowance is provided for. These allowances to small holders are regarded as transition payments. Other and longer time measures provided for in the legislation include aid in consolidation of small farms and gradual provision for development of self-supporting farming units. (7)

Thus, the postwar agricultural policy of Sweden aims to maintain a large enough agricultural industry to feed its people in case of need, and to give farmers on efficiently operated farms earning opportunities equal to other occupational groups of comparable skill. Whatever measures are taken to achieve these objectives will have important repercussions on the dairy industry because it is truly the mainstay of Swedish agriculture.

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BREEDS OF DAIRY CATTLE IN SWEDEN

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There are three distinct breeds of dairy cattle in Sweden: Swedish Lowland cattle, Red and White cattle, and Swedish Polled cattle. All of these breeds were developed through crossing known European breeds on native cattle of Sweden followed up by selection and record keeping.

There are three distinct areas in Sweden based on climate and topography of the land. In southern Sweden, referred to as the Lowlands, the climate is mild. This is the home of the black and white Swedish Lowland cattle--also called Swedish Friesian--that were developed largely through the use of bulls imported from the lowland countries of North Guernsey and Friesian. The cows weigh about 1,200 pounds at maturity. In 1947, the 16,685 cows on test produced an average of 10,179 pounds of milk testing 3.68 percent of butterfat. In 1946-47 one cow-testing association recorded 25 cows with yearly records ranging from 660 to 807 pounds of butterfat. Since the cattle are large, it is essential that large quantities of fodder and good pastures are made available.

The Red and White breed is found in central Sweden and has been developed by crossing the native cattle of this section with Ayrshires and Shorthorns imported from Great Britain. These cattle show excellent dairy type. The cows weigh between 1,100 and 1,200 pounds at maturity. In 1945, 251,164 cows of this breed were tested and made an average of 7,893 pounds of milk testing 3.97 percent of butterfat. The best record made in 1947 was 17,240 pounds of milk and 808 pounds of butterfat testing 5.15 percent. This breed is more hardy than the Swedish Friesian or Lowland breeds.

The Polled cattle are found in the northern part of Sweden where the climatic conditions are much more severe than in central and southern Sweden. The Polled breeds are made up of two rather distinct types and were developed largely through selection among the native cattle. About the only thing in common in these breeds is that they do not have horns. One type is referred to as Swedish Mountain cattle and the other is called the Red Polled native breed. The Swedish Mountain breed is largely white with black or red markings, while the Red Polled Swedish are red. The cows of the Polled cattle breed weigh on the average about 850 to 900 pounds. Cattle of this breed are not as heavy milkers as the other two breeds but they are well adapted to the rigorous climate and the relatively short supply of feed available in this region.

The available data on the production of the Polled breed for the year 1946-47 show production of 6,317 pounds of milk testing 4.35 percent of fat.

Milk recording societies have been in operation in Sweden for more than 50 years. The first was the Hvilan Milk Recording Society in Skane, which was organized in May 1898. Forty thousand herds, comprising 452,000 cows, were tested in the year 1946-47. The total cow population of Sweden in 1948 was 1,704,000. The milk recording societies are subsidized to some extent from public funds.

The cattle are kept in the barns the greater part of the year due to the cold climate. The barns are so constructed as to facilitate the production of high quality milk. Programs are set up for testing the cattle for tuberculosis and abortion. Extra bonuses are paid for milk from herds free from tuberculosis. The Public Health Act prescribes certain rules and regulations governing the health and freedom from disease of the persons handling milk in the dairies.

The herd book associations in Sweden, as well as in all European countries, follow the practice of the open herd book, which permits the farmer to develop a herd from unregistered stock that can eventually be registered.

DAIRY CATTLE NUTRITION IN SWEDEN

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Introduction

Little technical information on the nutrition of dairy cattle in Sweden could be obtained from the scientific sessions of the XIIth International Dairy Congress. Only one paper falling in this category was given by a Swedish worker and this was concerned more with effect on the product than on the animal herself.

It was necessary, therefore, to obtain information in this area through conferences with research workers, and through observations of feeding practices and of the condition of animals on farms.

General

Only 11 percent of the total area of Sweden is in tillable land. There are 400,000 farms averaging about 22 acres in size, and yet this country is 92 percent self-sufficient with respect to food. This means that farming is very intensive and that production is efficient and at a high level. This has resulted from increased use of fertilizers (one-third more than previous to World War II), greater mechanization, and to application of science and technology through education.

General farming predominates on such small holdings but dairying is the principal enterprise and accounts for 45 percent of the income, resulting from production of almost 2,000,000 dairy cattle with an average yearly production of about 5,500 pounds.

The size of farms, the climate, and the diversified agriculture provide conditions that differ widely in various sections of the country. This is reflected in the breeds of cattle and the systems of feeding that prevail.

Restrictions imposed by the war resulted in shortages of concentrates and especially of oil cakes. This was reflected in increased use of roughages and stimulated research in pasture improvement and forage utilization. New mixtures are constantly appearing on the market and an

effort is being made to test and evaluate them at the various experiment stations. In southern Sweden where sugar beets are grown on a large scale, the preservation and utilization of the waste products of sugar manufacture are important problems. Even beet tops are ensiled and fed in large quantities. In the potato-growing district the by-products of distilleries and starch factories are used for fodder, and direct feeding of potatoes is being practiced to some degree. In central and northern Sweden, pasture and green forages are of prime importance, while in the extreme north the short growing season imposes a problem of developing special types of highly nutritious, protein-rich forage which can be pastured for a short period and preserved as hay or silage for winter feeding.

In southern and to some extent in central Sweden where there is an abundance of good pasture and high quality roughage the Swedish Lowland cattle predominate. These are comparable to Holstein-Friesian cattle in the United States both as to origin and physical characteristics.

In central and to some extent in northern Sweden the Red and White cattle predominate. This breed is somewhat smaller and hardier than the Swedish Lowland cattle and resembles somewhat the Ayrshire, which breed actually comprised one of the crosses used in developing the Red and White cattle.

Swedish Polled cattle are found almost exclusively in the northern provinces of Sweden. They are considerably smaller in size than the Lowland cattle and are adapted to limited grazing conditions and to the rigors of a severe climate. Two types of Polled cattle predominate: the Mountain breed (white, with black or red markings) and the Red Polls which are entirely red.

The following production records of these breeds are remarkably high and suggest that while there is some reflection of the environment and natural feed supplies, barn feeding during the long winter season of central and northern Sweden must be generally at a high level of nutrition.

Table 1.-Yearly production of tested cows in Sweden, 1948 (Based on 12 tests per year)

Breed of cattle	Production		
	Milk	Butterfat	
	Pounds	Percent	Pounds
Lowland cattle	11,587	3.79	440.0
Red and White cattle	9,489	4.06	385.0
Polled cattle	7,317	4.35	319.0

The above records of production, together with the average production per cow of 5,500 pounds of milk and 220 pounds of butterfat, are comparable to the records of dairy cattle in the United States and suggest that unless there are some special genetic factors for high production involved the nutritional status of dairy cattle in Sweden is at as high a level as in the United States. Examination of the feed supplies and of the feeding practices will throw further light on this point.

That forage utilization plays an important part in the nutrition of dairy cattle in Sweden is evident from the fact that there are 2,480,000 acres of natural pastures and meadows and 4,000,000 acres of cultivated land devoted to grass and clover as a source of pasture and hay. Most of the remaining arable land is also used for feeding-stuff production--cereal grains (wheat, rye, barley, oats), potatoes, and roots (turnips, swedes, fodder carrots, fodder beets, fodder sugar beets). To supplement these natural sources of feed nutrients are by-products of distilleries, breweries, oil-cake mills, sugar and starch factories, bread mills, dairy plants, slaughter houses and the fishing industry.

Research

In view of this varied assortment of feedstuffs from which to draw it is difficult to conceive of any known nutritional deficiency theoretically to exist in milking cows. This was borne out by inquiry and observation, with one exception--phosphorus. Although clinical symptoms of phosphorus deficiency are rarely seen, on the basis of existing knowledge regarding phosphorus requirements, there is often a deficiency of phosphorus in the ration due to a low content of phosphorus in the hay and to the small amount of high protein concentrates available. During and since World War II oil cakes have been limited in supply, and are therefore rationed and expensive. Small compensation for this has been effected through production of some oil-bearing crops.

Farmers seem to be aware of the need for phosphorus in the ration and raise questions as to the relative value of phosphorus in supplements such as disodium phosphate, dicalcium phosphate, and bone meal, and the value of phosphorus in phytin-rich concentrates such as wheat bran. In recognition of this problem rather elaborate experiments on phosphorus utilization and on phosphorus-calcium relationships are under way at The National Animal Experiment Station, Ultuna.

Aware of the basic importance of good roughages in economical milk production, the Swedish dairy production scientists are concerning themselves more and more with digestion and utilization trials with various kinds of forage crops and with systems of preserving forage crops via the silo. It is interesting to note in this connection that the A.I.V. system of preserving silage, long the standard method in northern Europe, is now rapidly declining in popularity among farmers. Consequently research workers have patterned their programs after the American work on grass silage in the hope that wilting, in areas where the climate is suitable, or the addition of cereal grains, since there is no corn, or the use of molasses, will offer more acceptable and equally satisfactory procedures. Grass silage is now used very extensively in Sweden and is probably the greatest contributing factor to satisfactory winter rations for dairy cattle.

New methods of preserving silage are now being tested. These involve the use of Formosil (sodium formate) and Kofa-salt (calcium formate and sodium nitrite). Results from this work should be followed with interest. The effects of time of cutting and of method of preservation of green forage crops are being studied jointly to determine the stage of growth at which these crops are most nutritious, whether preserved by drying on racks or by ensiling.

Nutrition work on proteins, minerals, and vitamins is quite basic in nature and is concerned more with establishing requirements than with comparisons of various sources. This is also true of energy needs and is exemplified in the work at the Animal Breeding Institute, Wiad, where through the use of identical twins quantitative requirements for growing

animals and for milk production are being established by comparing levels of intake that are 60, 80, and 120 percent of the Scandinavian standard. The use of identical twins offers a possible technique that might profitably be employed in qualitative nutrition research as well as quantitatively as now being emphasized in Sweden.

Since a great number of young stock are now on hand for herd replacements considerable experimental work is being done in systems of raising calves, particularly from the standpoint of conserving fat and reducing the cost of raising heifers. It has been found that calves do equally well on milk containing 4.0, 3.5, 3.0, 2.5, and 2.0 percent fat. At a level of 1.5 percent fat calves scoured and failed to gain normally. It was concluded that the lower limit of fat in milk for calf feeding is 2.0 percent. This work is being done at various locations, using calves of the predominant breeds.

An interesting product with perhaps special nutritive properties that might bear consideration here is "betfor," a dried combination of beet protein obtained from solids recovered in the production of sugar, beet pulp, and molasses. This product contains 11.5 percent total protein, 0.3 percent fat, 61.5 percent N.F.E., 10.5 percent fiber, 8.2 percent ash, 6.4 percent true protein, 0.69 percent calcium, and 0.03 percent phosphorus. In digestion experiments with cows high coefficients of digestibility were found. In milk production trials "betfor" replaced either fodder root crops or grain and wheat bran and was found to have a feeding value equivalent to that of oats. This unusual product has certain economic advantages in that it enables utilization of proteins that previously had been wasted, withstands long-distance shipment, and serves as a concentrated form for distributing molasses.

Emphasis seems to have been placed on digestibility studies with various kinds of roughages and concentrates, using the chromic acid marker technique. Digestibility coefficients obtained are similar to those reported for comparable American feedstuffs. Of particular significance is some recent work on digestibility of whole crushed (rolled), coarsely ground, medium ground, and finely ground grain. After crushing, the digestibility of the organic matter of oats rose from 55.8 to 71.3 percent. Medium grinding and fine grinding decreased digestibility somewhat, with the exception of ether extract, which increased in digestibility with the fineness of grinding. In the case of barley optimum digestibility occurred with medium grinding.

Sterility is a problem among Swedish dairy cattle, as it seems to be everywhere. Attempts to relate infertility in bulls to nutrition have given negative results. Twin bulls at the Wiad station were fed at various levels of intake ranging from 1,567 to 2,531 Scandinavian feed units from 45 days of age up to 18 months. Increased intensity of feeding speeded up body processes generally--growth in liveweight, growth of testicles, occurrence of sexual activity, and extent of sperm production. However, the variation in the number of sperms in each ejaculate when calculated between bulls on the same feeding level was almost 12 times larger than the variation between the twins within the twin pairs. This is interpreted to mean that the sperm producing capacity of bulls seems to be determined mainly by heredity. This same relationship was observed for readiness to serve and servicing ability.

Observations

A number of farms having herds of various sizes were visited. As one might expect, the feeding practices employed varied according to

available home-grown supplies and the knowledge of the feeder. In general, pasture plus some low protein grain mixtures or commercial feeds containing about 16 percent protein were used, together with roots of various kinds according to availability. For winter feeding hay (clover mixtures and in some cases alfalfa) is fed rather sparingly but ensiled beet tops and grass silage are fed liberally and supplemented with dried beet pulp, distillery by-products, and commercial mixtures containing blends of oilmeals. It is generally recommended that the concentrate part of the ration contain about 16 percent total protein and that grain be fed in accordance with production, much as in the United States.

In general the animals of all ages seen looked thrifty and well fed. Existence of obvious nutritional deficiencies was never suggested, nor were any observed.

When one reflects on the basic nutritional needs of dairy cattle, for energy, protein, fat, fiber, minerals, and vitamins, and considers the available feed in Sweden, the limiting factor would seem to be amount of feed rather than lack of any particular nutrient other than phosphorus, as previously mentioned, fat, and vitamin D.

Phosphorus deficiency is readily overcome by use of phosphorus-containing minerals. Since there is some controversy concerning the need for a minimum amount of fat for milk production, this may be of no significance, although it can be estimated that without corn and with such a large intake of roots and cereal grains the fat content of dairy rations in Sweden is rather low. The long barn feeding period without exposure to sunlight and the limited supply of sun-cured hay suggests the possibility of need for supplemental vitamin D. Some vitamin D undoubtedly comes from fish by-products and through feeding cod-liver oil, but until more definite evidence is available regarding the need for large amounts of vitamin D for milk production and gestation no real problem in this respect would seem to be presented. Vitamin A would seem to offer no problem for the use of pastures and meadows in the summer plus liberal use of root crop tops and grass silage in the winter should supply adequate amounts of carotene.

No information was obtained on the need for minor elements nor was there apparent the type of exploitation prevalent in the United States regarding special mineral and vitamin preparations. In spite of this milk production per cow is at a high level, quality of the milk is high because of sanitary requirements that must be met, and food value also is high because of the feeding systems employed.

It is expected that a relatively strong increase in demand for milk and dairy products will develop in Sweden. To meet this demand further increases in production levels can be obtained through more liberal feeding and through increasing dairy cattle numbers to the prewar level or slightly above.

COOPERATIVE DAIRY MARKETING IN SWEDEN[1/]

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Sweden has about 1.7 million cows, with a total milk yield of approximately 10 billion pounds in 1949. This is about one-sixth greater than the quantity of milk produced in New York State the same year. Sweden's population is about 6.5 million, or approximately half the population of New York State. The per capita consumption of fluid milk in Sweden is greater than ours yet only one-third the total production is utilized as fluid milk and cream. Aside from relatively small amounts used for livestock feeding, the remainder is utilized in the manufacture of butter, cheese, condensed, evaporated and dried milk, etc. In the United States, by comparison, nearly half the milk produced is utilized as fluid milk and cream.

Cooperative Organization of Dairymen and Other Farmers

Fully 95 percent of the milk that goes to dairy plants in Sweden is controlled by producers' cooperatives. Nearly all milk distribution in the cities is now done by cooperative associations, and the business has been almost completely centralized. In Stockholm, for instance, a city of 700,000 and the largest in Sweden, one large cooperative distributes nearly all the milk. The one private distributor buys his milk from the cooperative. So there is a minimum of competition. A similar situation exists in the other Swedish cities.

The local dairy cooperatives in Sweden are tied into a national organization, the Swedish Dairies Association, commonly known as the S.M.R. This organization was set up in 1932 in the midst of the agricultural depression which engulfed the Swedish farmers as well as our own. The S.M.R. was organized by some exceedingly capable farm leaders with encouragement and assistance from the government. Its main purpose was to regulate the supply of dairy products going to market and thus obtain prices acceptable to producers. The local cooperatives already in existence as well as many new ones were combined into district federations, and centralized dairy associations, which in turn were joined in the S.M.R. The membership of the S.M.R. consists of 20 district federations and 9 central dairy associations, representing nearly 250,000 dairy farmers, and having an annual turnover of about 250 million dollars.

The Swedish Dairies Association (S.M.R.) is tied into the country-wide farmers' organization called the Lantbruksförbund or Federation of Swedish Farmers' Associations. While cooperation has had the fullest

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1/ This statement is based on information obtained through interviews with officials of the Swedish Dairies Association (S.M.R.), with executives of the cooperative central milk plant at Stockholm (Mjölkcentralen), and with one of the two men chiefly responsible for the development of cooperative dairy organizations in Sweden since 1930; also from publications of the Swedish Dairies Association, and the Milk Centralen, and from reports prepared in the office of the Agricultural Attache, American Embassy, Stockholm; also through visits to two important plants of the Milk Centralen--their chief milk processing plant in Stockholm and a dairy products plant at Rimbo, about 25 miles north of Stockholm.

development among dairymen, other groups of farmers also depend on cooperatives to a great extent for the marketing of their products. About 70 percent of the slaughter animals, 65 percent of the grain and eggs, and a high percentage of the forest products sold by Swedish farmers are marketed through cooperatives. A cooperative selling and purchasing organization supplies a large part of the feed, fertilizer, equipment, and other supplies used on Swedish farms and cooperative farm credit agencies are of considerable importance. An idea of the relative importance of the dairy and other types of cooperatives may be had from the following:

Cooperative Agency	Total sales, 1944 (million kroner)
S.M.R. (Milk)	745
S.S. (Livestock)	305
S.L.R. (Grain and farm supplies)	320
S.S.R. (Forest products)	182
S.J.K. (Credit)	1/ 154
S.A. (Poultry and eggs)	27

1/ Volume of loans made.

While cooperative organizations among Swedish farmers had developed considerably in Sweden before 1930, it was mainly during the years of severe agricultural depression, 1930-34, that the high degree of cooperative control now in evidence was achieved. The rapid promotion of dairy cooperatives during that period went hand in hand with that of other cooperative groups. The result of this movement was to place the Swedish Dairies Association and its member groups in almost complete control of the marketing of dairy products in that country.

Objectives of Cooperative Dairy Organization

As previously indicated, the main objective of the S.M.R. at the time of its formation was to raise the prices of dairy products to a level that would be acceptable to the farmers. The principal method used for the purpose was to export a sufficient part of the output of dairy products of Sweden so that the remainder could be sold in the home market at satisfactory prices.

The plan of operation was that each local cooperative should be responsible for the disposal of milk and dairy products in its own territory. Any surplus was to be turned over to the district federation, whose job it was to even out supplies within its larger territory. The district federations in turn called on the S.M.R. to take care of surpluses they could not dispose of, and to provide supplemental supplies for deficit areas. Losses on export sales were made up by equalization fees authorized by the government and assessed on all milk delivered to the dairy plants.

The efforts of the S.M.R. to restore the prices of milk and dairy products to a more satisfactory level were greatly aided of course by the general economic recovery following 1933.

Leaders of the remarkably successful drive for cooperative organiza-

tion of the dairy industry in Sweden, which began in 1930, say that raising and stabilizing prices was not the sole objective. Another important purpose was to make possible the reorganization and "rationalizing" of the dairy marketing system--the elimination of small plants through consolidations, the modernizing of the remaining plants, and reduction of duplication in hauling, and in deliveries. This program has been pushed aggressively during the 18 years since the S.M.R. was organized.

The Central Dairy Association of Stockholm (Milk Central)

The largest of the central dairy associations that are included in the S.M.R. is the "Milk Central," with headquarters in Stockholm. This association was first established in 1915 and has a membership of about 30,000 farmers in five counties on the eastern side of Sweden. This area includes the Stockholm milkshed but extends beyond it. The Milk Central has a near-monopoly of the dairy business in its territory--both in the distribution of fluid milk and in the manufacture of dairy products. It operates 51 plants which receive more than 400,000 gallons of milk daily. This is about one-fifth of the total milk shipped to all dairy plants in Sweden. The annual sales of the association come to about 75 million dollars, which is about one-third the total sales of all cooperative groups included in the membership of the S.M.R. The average size of herd kept by association members is eight to nine cows.

The process of rationalizing and consolidation has resulted in the closing of more than 300 of the 355 dairy plants that formerly existed in the territory served by the Milk Central. The average daily receipts at the remaining plants exceed 7,000 gallons.

Utilization of Milk Received

About half the milk taken in at all plants of the Milk Central is utilized in fluid sales. The remainder, with the exception of skim milk returned to the farmers, is used for manufacture. Each year nearly half a million gallons of skim milk return to the farms for feeding calves, pigs, and chickens. The Milk Central plants make 2.5 million pounds of butter a year but distribute a much larger quantity. The additional supply is obtained through the S.M.R.

The Milk Central makes more cheese than any other organization in Sweden. The yearly output, including both hard cheese and many special types, is upwards of 20 million pounds. This cooperative also is said to be the oldest as well as the largest producer of sterilized cream which is distributed through retail shops in collapsible tubes.

Only 20 percent of the milk handled by the Milk Central comes direct from the farms to the processing plants in Stockholm; the remaining 80 percent being received at country plants.

A new plant built in 1949 to be the principal surplus plant in the Stockholm milkshed is equipped to receive 46,000 gallons of milk a day, and to manufacture evaporated and spray-dried milk. The cooperative plans to make up a stock of dried skim milk during the season of flush production each year, and release it to the farmers in the fall when most of the milk currently produced is needed for the fluid milk trade.

The Milk Central has another surplus plant at Rimbo, about 25 miles north of Stockholm. This plant was visited by the writer in company with other American participants in the Dairy Congress. It receives 10,000 gallons of milk a day from 800 farms. At times it also

receives substantial quantities of cream from other plants. In 1948, just about half the milk received at this plant was shipped to Stockholm for fluid use, and the other half was used for the manufacture of butter and cheese. Here, as at the Stockholm plant, the housekeeping was good and the equipment in fine condition. The most interesting piece of equipment at the Rimbo plant was an Alfa continuous buttermaking machine, with a capacity of 1,000 pounds of butter an hour. The plant is cooperating with the manufacturers of the butter machine in trying out certain supplementary equipment--in particular, a covered conveyor belt 30 feet long on which a thin layer of butter is given an opportunity to harden as it moves toward the printing machine.

Fluid Milk Operations

Earlier in this paper, it was stated that one large cooperative, the Milk Central, distributes nearly the entire milk supply of Stockholm--Sweden's largest city. This statement can be expanded to include all cities and towns in the five counties served by the association, except to the extent these places are served by producer-distributors. The entire trade area of the association embraces a population of nearly two million, or about three times the population of Stockholm alone. More than 3,000 stores, restaurants, and other trade outlets are supplied with milk and other products. The association itself operates 75 milk stores in Stockholm and 150 outside Stockholm. In the city, the Milk Central has a main milk-processing plant and three branches.

The main plant of the Milk Central in Stockholm, which I visited twice in August 1949, is very well equipped, from the standpoint of both efficiency of operation and ability to turn out a high-quality product. The arrangements for receiving and weighing-in milk at this plant, including automatic dumping and weighing devices, surpass any that I have seen in the United States or elsewhere. The offices and reception rooms are most attractive, and the plant has the appearance of being a good place in which to work.

Another outstanding feature of the cooperative milk plant in Stockholm is its research laboratory. In it are some of the most modern electronic devices. Leading American authorities in dairy technology who visited this laboratory expressed the opinion that it has no equal in the United States.

The weakest links in the set-up and operation of the Stockholm cooperative milk plant appear to be a lack of adequate cold room capacity, and the practice of returning skim milk to the farmers. At the time of my visit there last August, the management had plans ready for a new building which will double the capacity of the present plant.

The practice of returning skim milk to farmers from city milk plants as well as country creameries is common in the Scandinavian countries and in Germany. It is objectionable from the standpoint of sanitation, since responsibility for cleaning and sterilizing the cans in which the skim milk is returned must be left with the farmers. It also imposes extra expense.

Another phase of the Stockholm milk operation that might be criticized is that only about half the milk is bottled. The other half which includes the milk to many stores as well as for restaurants, etc., is distributed as loose milk. For reasons of economy, the sale of loose milk is common practice in many European countries.

In Stockholm practically all the milk for home consumption is distributed through stores. None is delivered from house to house. The management of the Milk Central indicated to me a desire to resume home deliveries in certain areas now that trucks and other equipment are more readily available, but the government will not allow a higher price

for home deliveries than for store sales.

Delivery of Milk

In August 1949, the Milk Central was operating 160 delivery routes in the Stockholm area. Most of the routes were handled by one man, but some had two men. The one-man routes delivered between 3,000 and 4,500 quarts of milk a day, while the daily volume for two-man routes was between 5,000 and 7,000 quarts. These loads are about two to four times as large as those delivered by the wholesale routes of most distributors in the larger American cities, such as Boston, New York, Philadelphia, and Chicago.

The drivers were paid a straight salary of 126 kroner a 48-hour week, equivalent at the rate of exchange then in effect to about $35. The wages of plant employees were somewhat less--about $30 to $32.50 a week for men, and $22.50 to $25 a week for women.

Only one grade of milk is sold--namely, pasteurized milk, standardized to contain 3 percent fat as required by a wartime regulation.

A very special product distributed by the Milk Central is mothers' milk. About 150 quarts are collected and distributed daily in cooperation with medical authorities.

Distribution Through Stores

The stores that sell milk in Stockholm are specially licensed, and are permitted to sell only certain types of bottled or packaged goods besides dairy products. They are kept under close supervision by municipal authorities. Some stores have refrigeration but the majority do not. All newly licensed milk stores must be equipped with refrigeration. The Milk Central has some very modern and attractive stores, which evidently are intended as examples to be emulated by private shopkeepers.

As long ago as 1932, a committee of milk distributors and storekeepers was formed in Stockholm to regulate the sale of milk to stores. The object was to restrict the number of stores selling milk. Sweden, like great Britain and other European countries, has no antitrust law and apparently such private arrangements as this, which restrict free enterprise, were not objectionable to the government. I was told that in 1939 there were 39 milk stores per 10,000 people in the Stockholm area. At present there are less than 30 per 10,000 people. The aim of the Milk Central management is to limit the milk stores to the minimum number required for reasonably adequate service to all consumers. The plan is to arrange the store locations so that a milk supply will be available within 500 feet or less of each family residence. Since the Milk Central controls practically all milk within its trade area, its management can dictate the number and location of milk-selling stores unless the government disapproves.

Similar policies with respect to regulating the number and location of milk stores have been adopted in Norway and in Germany.

Prices Charged and Paid by Stores

In August 1949, the retail prices of milk at stores in Stockholm were 36 öre a liter for bulk milk and 40 öre for bottled milk. These prices were equivalent to 10 cents and 11 cents a quart, respectively. The prices paid by the stores were approximately 8.8 cents and 10 cents a quart, leaving storekeeper margins of approximately 1.2 cents on bulk milk and 1 cent on bottled milk. All these prices were controlled by the government. In addition to the margins indicated, the stores

received a subsidy equivalent to about one-fifth cent on each quart of milk handled.

In the smaller cities and towns, lower schedules of prices were in effect.

Prices Paid Farmers

For May 1949, farmers supplying milk to Stockholm were paid 29.6 öre per kilogram or $3.76 per hundredweight for 3.5 percent milk. This was a pool price computed by the S.M.R. as explained below.

The S.M.R. receives reports from all plants in the country by the 12th of each month, showing the quantities of milk received, the butterfat percentage, the quantities used for different purposes, the amount of skim milk returned to farmers, and the price charged for it. These reports are summarized in the S.M.R. office at Stockholm. Private dairies and non-affiliated cooperatives as well as member associations report to the S.M.R., because that organization acts as agent for the government in distributing subsidy payments.

The various plants are assessed at specified rates on their sales of fluid milk, light and heavy cream, and cheese. These assessments go into an equalization fund that is distributed about four times a year.

During the 12 months ended with August 1949, the government made a contribution of 70 öre per kilogram of milk to all dairymen. This was equivalent to 32 cents per hundredweight. Additional government payments were made to dairymen on a regional basis ranging from nothing in the Stockholm area to as much as 55 cents per hundredweight in the more remote areas of northern Sweden.

Moreover, since 1940 the Swedish government has required that the dairy plants pay the cost of collecting milk from the farms. The government in turn reimburses the plants for hauling costs in excess of 15 cents per hundredweight.

Somewhat similar practices have been followed in other Scandinavian countries and in Great Britain since the beginning of World War II, to reduce or eliminate differences in returns to producers resulting from their location at varying distances from the principal markets.

The prices fixed by the government for milk and other farm products and the amount of subsidies paid are arrived at each year through negotiation between the government and the Lantbruksförbund. The first step is to determine the total amount of gross income that all farmers should have and how much should go to dairymen and other groups. The principal consideration in making this determination is the amount of change in farm production costs from those experienced in the base period, 1933-37. When the goal as to total gross farm income has been determined, the government proceeds to decide how much of this income should be obtained through market sales at fixed prices, and what additional amount must be provided by government subsidies.

Negotiations between government officials and representatives of the Lantbruksförbund were under way at the time of the Dairy Congress sessions at Stockholm in August 1949, to determine the farm income, price and subsidy rates for the year beginning September 1. The government was offering total farm subsidy payments of 50 million kroner, and the farm representatives were demanding 120 million kroner. A compromise was expected in the neighborhood of 80 million kroner, with probably a permitted increase of 2 öre per liter in the retail price of milk.

Controlled prices and subsidies play a very important role in the Swedish national economy. Since wage rates are tied to the index of

living costs, avoidance of increases in food prices is a key factor in the government's whole program of price stabilization.

While there has been a definite tendency to reduce or eliminate price differences based on the farmer's location, there has been no departure from the principle of maintaining price incentives for quality. It is required by law that all milk received at dairy plants in Sweden be paid for according to its fat content and certain other quality factors. The price differential for each .1 percent of fat must be at least equivalent to the market value of butterfat. Composite samples are tested three times a month.

Two classes of milk are established in recognition of differences in sediment, flavor, and odor. A discount is made in the price paid for milk in the second class. Milk also is classified according to its keeping quality; based on the Orla-Jensen reductase test. On the basis of this test, milk is divided into three classes, with appropriate price discounts on classes 2 and 3.

Conclusions

It is extremely difficult to judge the relative efficiency of dairy operations in a strange country. Comparisons of prices, price spreads, and marketing costs for milk in Sweden and the United States are complicated by the adjustment of fat content in the milk sold to Swedish consumers; by subsidy payments to Swedish farmers, plants, and stores; by differences in wage levels and hours of work; by differences in marketing services provided in the two countries; and above all, by uncertainty as to the true relationship between U. S. dollars and Swedish kroner.2/ For these reasons and because the writer's opportunity for study of Swedish dairy operations has been rather limited, the conclusions expressed herein must be considered as tentative and subject to revision after further study.

Certainly the prices charged consumers for milk in Sweden are very low in comparison with similar prices in American cities. Likewise the spreads between the prices that farmers receive for milk and the prices charged consumers are remarkably small even when allowance is made for the reduction in fat content of the milk and for subsidies paid to distribution agencies. Lower wage rates in Sweden are an important factor in the lower costs of distributing milk. The absence of home delivery of milk and lack of duplication in delivery service to stores in the same block also contribute importantly to the cheapness of milk in Stockholm and other Swedish cities.

The tentative conclusion reached by this writer is that the highly centralized cooperative dairy system in Sweden is remarkably successful and efficient. This tentative conclusion is based in part on the small spread between producer and consumer prices, after due allowance for the differences mentioned, and in part on the impressions gained from interviews with cooperative leaders and executives and personal inspection of certain plants and offices. Incidentally, the executive staffs of the cooperatives visited seem surprisingly young as a group, and give the impression of being remarkably alert and efficient.

The favorable tentative conclusion stated above is at variance with

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2/ In August 1949, the official exchange rate was approximately $.28 per kroner. This rate has been used throughout this paper to convert Swedish values to their American equivalents.

what this writer and other American observers would expect to result from an examination of any monopolistic situation such as this. Is there not evidence of the slackening of personal initiative, deterioration of service and like which we assume to be inherent characteristics of monopoly? Within the limits of this writer's observations, the question as it applies to the cooperative dairy system in Sweden must be answered in the negative. There were no indications that the organization as a whole or any of its important divisions is "going to seed."

One of the principal promoters and organizers of the Lantbruksförbund was asked how such all-inclusive cooperative organizations as the S.M.R. and the Milk Central could avoid the difficulties that we have come to associate with monopolistic situations generally. His reply was that the cooperative leaders in Sweden are fully aware of that problem. They are endeavoring, he said, to develop and promote a spirit of competition among the managements of different plants and cooperatives by circulating among them comparative data on operating efficiency. With this object in view, the S.M.R. has developed a cost and statistical service that I believe is unmatched for scope and thoroughness by anything of its kind in the United States. A great deal of emphasis is placed on the monthly and annual reports which give comparisons of operating costs and net returns for milk handled in the various plants of the member associations.

No inference should be drawn from the foregoing statement concerning the cooperative dairy system in Sweden that a similar set-up is desirable for the United States. There are important differences in the conditions which prevail in the two countries. In Sweden the cooperative dairy system fits into and is a part of a broad fabric of cooperative organization and effort. Per capita incomes are lower in Sweden than in the United States, although the Swedes probably have the highest standard of living in Europe. Consumers, farmers, and industrial workers in Sweden cannot afford as well as their cousins in America the luxury and satisfaction of freedom of choice based on competitive enterprise.

And finally, it must not be overlooked that the centralized cooperative dairy system in Sweden has operated for many years in a war economy. Whether it will continue to operate so successfully when wartime and early postwar shortages give way to surpluses and when many wartime regulations to which the people have become accustomed fall by the wayside, remains to be seen.

DAIRY PRODUCTS IN SWEDEN

H. H. Sommer, Professor of Dairy Industry,
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Dairying is an important industry in Sweden, producing about 45 percent of the agricultural income. The total annual milk production is approximately 10 billion pounds. Only a little more than three-fourths of this is delivered to dairies; the rest is used for home consumption and local sales directly from the producer to the consumer. The milk delivered to dairies is produced on about 200,000 farms and in 1948, 97.6 percent of this milk was handled through cooperatives.

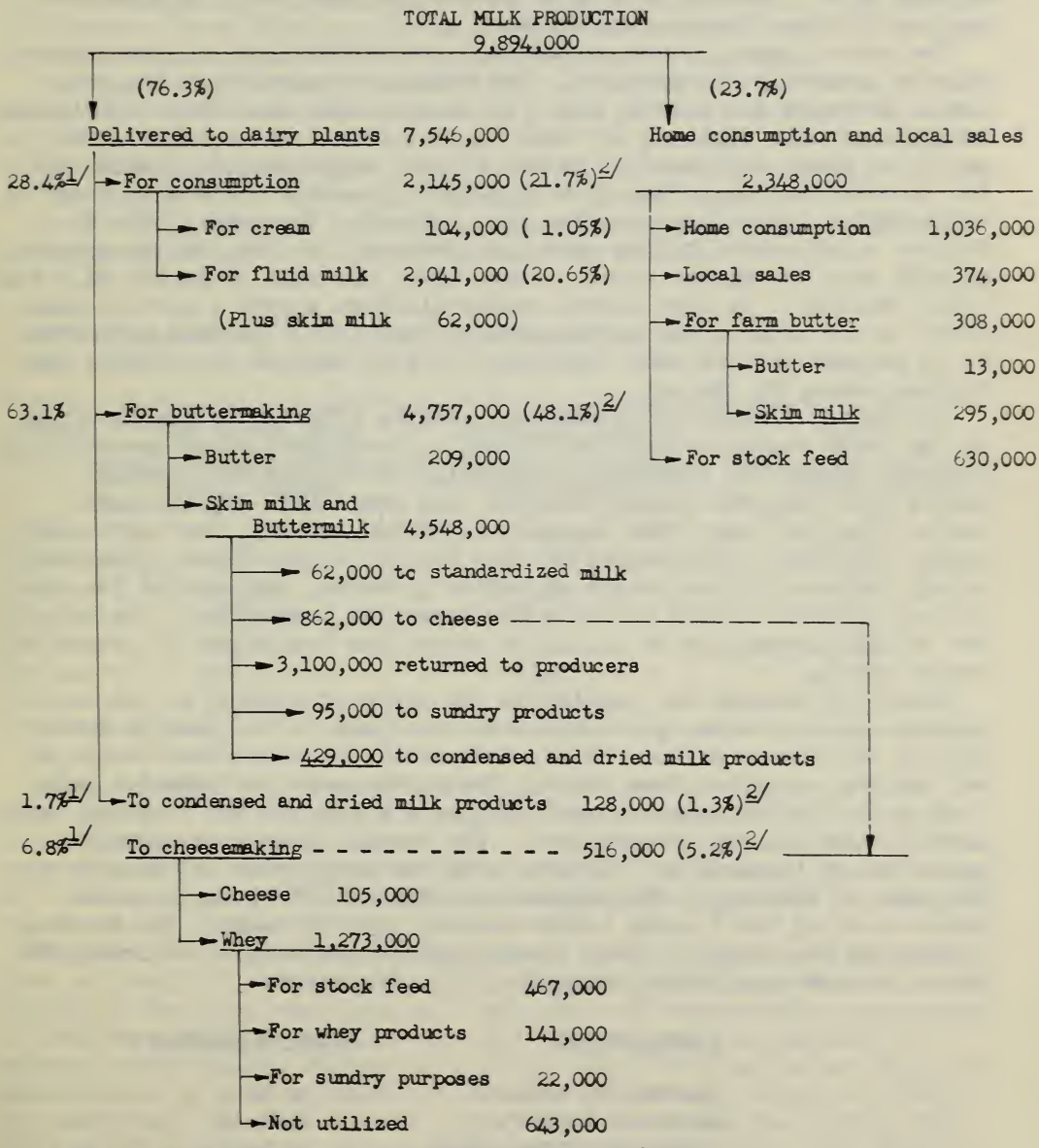
The number of dairy plants has declined with each succeeding year from 1,628 in 1934, to 741 in 1947, and to 701 in 1948; but during that time the total amount of milk handled by the plants actually increased about 35 percent. These data reflect the trend to merge and consolidate

the operations into a smaller number and larger plants, in the interest of increased efficiency of operation and improved quality of products. It is interesting to note, also, that under a Dairy Act passed in 1936, the dairy foreman in plants must have undergone training at a State or State-approved dairy school.

The relative importance of the various dairy products manufactured in Sweden can best be illustrated in terms of the amount of milk utilized for each product. The latest statistics of this type are for 1917.

Total Milk Production and Disposal in Sweden in 1947

(Thousands of pounds)



1/ Based on the milk assembled in dairy plants.
2/ Percentage of total milk production.

A relatively high percentage, 23.7 percent, of the milk produced is used for home consumption and small scale neighborhood sales by the producer. An important factor in this milk utilization is the fact that the average farm in Sweden is small, and while about a third of the population lives on farms, at least one-fourth of these farm dwellers are otherwise employed, chiefly in forestry.

Of the milk assembled in dairy plants, 48.1 percent is used for buttermaking, 28.4 percent for milk and cream for consumption as such, 6.8 percent for cheese and 1.7 percent for condensed and dried milk products. Thus, buttermaking is the principal dairy plant operation. Buttermaking occupies the dominant position not only in volume of milk used, but also as a contributor of skim milk for the standardization of market milk and the making of cheese, much of which is made from part-skimmed milk. Because of this interrelation, many dairy plants are engaged in these three enterprises.

The use of cream is not as extensive as in the U. S. A., and market milk is generally standardized. The milk as received from the producers averages 3.6 percent fat. It is not clear from their statistical analysis of milk disposal for 1947 to what extent the 2,041,000,000 pounds of whole milk used as market milk is supplemented by skim milk for standardization. They show 62,000,000 pounds of skim milk from buttermaking operations used for this purpose. Presumably this is further supplemented by the skim milk derived from 104,000,000 pounds of milk used for market cream. Since 1939, the sale of market milk has almost doubled. To what extent standardization played a part in this trend is not clear. Standardization of milk to 3.0 percent and cream to 15 percent fat was made compulsory in 1941 because of critical conditions caused by the war.

The butter industry of Sweden was greatly affected by the blocking of the trade routes during World War II. Previously about one-third of Sweden's butter was exported, principally to England and Germany. During 1939, exports dropped sharply, and since 1940 exports have ceased. In 1947 they even imported 2,398,000 pounds. The additional supply of butter, represented by this loss of export trade, plus some actual increase in the amount of butter produced, compensated for the loss of imports of fats and oils for margarine production. The annual per capita consumption of butter in Sweden has been about 30 pounds in recent years.

Butter is branded for quality on the basis of scoring by judges, keeping quality tests, and composition analysis by the Swedish Butter Testing Station at Malmö. Butter that meets the prescribed standards may use the so-called Rune Brand. The butter must not exceed a moisture content of 16 percent, must not contain any aniline coloring, and must not contain any preservative. The scoring is done on samples requested by telegram or telephone with the samples to be taken from the make of that day. The samples are kept at 13° C. for 2 weeks before scoring and 3 weeks before keeping quality tests. The scoring is done by six judges. Their scoring system is designed to reveal the three separate qualities, using the following scale:

Items scored	Range of points
Flavor and aroma	1 to 6
Body and texture	1 to 3
Other characteristics	1 to 3

The score for the Rune Brand butter must not be under 4-2-2.

Sweden has had very little import or export trade in cheese. Since practically all of the cheese is made for home consumption, the cheese that is made is of the type originally made in small scale, home dairy operations of the last century; there are two distinct types--Svecia, and Herrgårdsost. Both are of the same general size and shape as our "Daisies," and running to somewhat larger sizes up to our "Twins." Both are "brine salted." The Svecia cheese is open in texture, showing numerous small "mechanical" holes and a limited number of gas holes. In flavor it is somewhat similar to a low moisture brick or Muenster cheese. The Herrgårdsost is characterized by its close texture except for a limited number of gas holes or eyes similar to Swiss cheese. It has a flavor resembling Swiss cheese to some degree but it is not an exact duplicate of Swiss cheese in flavor or size. Several practical dairy plant operators from the U. S. A. remarked on visiting Swedish dairies and sampling this cheese, that this type of cheese ought to sell well in this country. It would seem worthwhile to consider its introduction here.

The cheeses in Sweden are made at several different levels of fat content, expressed as percent of the dry matter. The cheese must be stencilled to show the fat content, e.g., 20+, 30+, or 40+. The Swedish Butter Testing Station also judges and analyzes Swedish cheese, and use of the Rune Brand on cheese is based on their findings.

Dried whole milk and skim milk production has increased rapidly in recent years as shown by the statistics for 1942-48.

Table 1.--Dried milk production in Sweden, 1942-48

Year	Dry whole milk	Dry skim milk	Total
	1,000 pounds	1,000 pounds	1,000 pounds
1942	2,324	421	2,745
1943	8,651	970	9,621
1944	7,683	1,204	8,887
1945	15,615	1,667	17,282
1946	18,545	3,499	22,444
1947	15,979	7,403	23,382
1948	15,849	8,642	24,491

About one-half of the dry whole milk is exported, mostly as spray dried powder. The 128 million pounds of whole milk shown as going to condensed and dried milk products in the analysis of "milk production and disposal for 1947," apparently went to dry whole milk, since a ratio of 1 to 8 in drying would require this much milk to produce 16 million pounds of dry whole milk.

The amount of dried skim milk is small in comparison with the total that is potentially available. It is interesting to note that about 68 percent of the skim resulting as a byproduct of buttermaking is returned to producers. The method they use for this return, as witnessed at several of the plants visited on a study tour, is to write the amount of skim desired by each producer on the side of the empty milk can after the whole milk has been dumped. Such marked cans are then filled with the specified amount of skim milk as metered into the can with the aid of a dial reading meter (10-inch dial).

As is true generally in various parts of the world, the whey

utilization problem has not been fully solved in Sweden. About 40 percent is used for stock feed, and nearly 13 percent is used for various products, but the rest, 47 percent, is not utilized. The chief whey products are mesost (whey cheese) and messmör (whey butter), and in recent years a product known as "bakkräm" (baking cream). The latter is used by bakeries and chocolate factories.

Casein is produced only to a limited extent--only 264,500 pounds in 1948.

It is significant that their statistical analysis of milk production and disposal does not show any milk utilized for ice cream. Presumably supplies for the limited amount of ice cream that is made are taken from the milk and cream shown "for consumption."

DAIRY PRODUCTS RESEARCH IN SWEDEN

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The dairy products industry in Sweden is engaged primarily in the preparation of market milk and cream and the manufacture of butter and cheese. In the production of these products the industry utilizes approximately 93 percent of the total milk supply (market milk 29, butter 50, cheese 14). It follows therefore that most of the problems of research in which the industry is primarily interested are closely related to these products or their byproducts, though some research is being conducted also on concentrated and dried milks.

Until recent years, practically all of the research work on dairy products had been conducted at the State institutions. However, as the industry expanded, it became difficult for these institutions to satisfy the needs for information in this field. The situation has been met by an increase in the research facilities and activities of both the State institutions and the various laboratories of the industry during the past 10 years.

The principal centers of these research activities are the Dairy Institute and Dairy College of the State Agricultural, Dairy and Horticultural Institute at Alnarp, and the various laboratories of the Swedish Dairies Association (SMR), the principal ones of which are: that at Örnsköldsvik, that of the Mjölkcentralen in Stockholm, and the control laboratory at Malmö.

The training of workers in the dairy industry also is carried on at the Alnarp Station. The instruction work is conducted in two schools, usually called the "higher" and "lower" schools. The work in the latter is designed primarily to train students for practical work in the industry. At present it consists of one year of training, which may be extended in the near future. The higher school is of collegiate rank and its 3-year curriculum is designed to prepare students for work as advisors, teachers, inspectors, etc. Although the primary function of the Dairy College is to train workers in the dairy field, the members of its staff also conduct research of a basic and theoretical nature. The members of the staff of the Dairy Institute conduct research of a more practical nature, though it is evident that no clear line of demarcation can be drawn between the work of the two divisions in many instances.

In recent years the Swedish Dairies Association (SMR) has also developed its own program of research and has given assistance to the

work at the State Dairy Institute. The research by the two organizations is not coordinated officially, but there exists a voluntary collaboration between the State laboratories and those of the Dairy Association which has proved effective, satisfactory, and to mutual advantage.

Specifically it cannot be said that the work in any one laboratory in the country is limited to one subject, though the SMR laboratory at Örnsköldsvik is interested in practical problems in the manufacture of cheese primarily and the laboratory at Malmö is interested in control work and control methods.

Aside from the research work on cheese relating to the effect of heat treatment (including pasteurization) on alterations in the coagulation characteristics of the milk, and to the effect of pressing, setting, and working of the curd, and to the different conditions of storage, on the quality of cheese obtained, the SMR laboratory at Örnsköldsvik has also conducted considerable work on the relationship between the fat content and protein content of milk throughout the seasons of the year, and on the flavor of D-vitaminized milk, and on the effect of light rays upon the flavor of milk.

Studies of a more theoretical nature, to determine the effect of various physical factors upon the nature of rennet curd, are being conducted at the Institute at Alnarp. In connection with the experiments on cheese, experiments on the more efficient utilization of whey have also been conducted. These have dealt principally with the problems of whey utilization through its fermentation and the isolation of the whey protein.

Some experiments on the manufacture of butter have also been conducted at the Örnsköldsvik laboratory. They have been concerned chiefly with the use of aroma-producing organisms and with the use of a special salt containing a small quantity of admixed buffer salt (AIV salt) to reduce the H-ion activity and thereby reduce the rate of spoilage in storage.

The SMR laboratory at Malmö is designed primarily for control work on butter and cheese. This laboratory performs various chemical and bacteriological tests, such as those for fat, moisture, pH, catalase, peroxide, bacterial counts, etc., for the various dairies. In addition to this routine work, investigations are also carried out on control methods and their applicability and reliability. This laboratory also prepares cultures for Roquefort and other types of cheese and for the past two years has prepared bacteriological media for control work.

Another problem of concern at both the SMR laboratories and the State Institute at Alnarp is the effect of feed upon the quality of the milk and/or milk products. Since some of the butter produced must be stored, the problem of preventing the variations in keeping quality that result from the use of different feeds has received considerable attention, especially at the Alnarp station. The effect of various feeds upon the vitamin content, especially vitamin A, of the milk has been investigated. Also, the variations in the protein content of milk have been studied, from the standpoint of both the inheritance of the cow and the feed used. On the basis of the fat-protein relationship studies, some consideration has been given to the question of basing the payment for milk on the protein content as well as the fat content. This has also raised the question of a rapid method for evaluating the protein content. Studies have also been conducted on the effect of variations in the handling of milk upon its quality, and also on the utility of various practical tests in evaluating

quality. Some thought has been given also to the possibility of using vitamin A content, hardness of the milk fat, etc., as bases for payments for milk.

Studies relating to pasteurization have been both bacteriological and chemical. The bacteriological studies have been related to the establishment of the conditions required for high-temperature short-time pasteurization, and the chemical studies have been related to the development of a reliable test for adequate pasteurization. In the latter case studies on phosphatase tests have received considerable attention. The bacteriological studies have been conducted primarily at the SMR laboratory of the Mjölkcentralen in Stockholm and the chemical studies at the Alnarp station. In addition to the studies on pasteurization at the SMR laboratory in Stockholm, fundamental studies on the efficiency of homogenization and of detergents are also being pursued. Problems related to the fat emulsion structure and to creaming are being studied at the Alnarp station.

The problems of the butter industry which have received considerable attention are consistency, or body and texture defects caused by seasonal variation in the hardness of the fat, and defects caused by oxidation. The former project has involved studies in the relationships between unsaturation and hardness, and consistency and hardness. The influence of variations in equipment, especially that of the continuous type churn, is also being studied. In addition to these practical studies, fundamental studies of the phase relationships in butters produced under different conditions and with different physical properties are being pursued at the Alnarp Institute. The studies on spoilage through oxidation have been intensive as well as extensive at the Alnarp station and at the SMR laboratory in Malmö. Methods for evaluating the rate and extent of oxidation, the effect of feeds, the effects of addition of antioxidants, the effects of variations in storage temperatures, etc., are a few of the problems under investigation. The manufacture of butter from ripened cream is also of special interest to their butter industry. The addition of various types of starters or of "butter flavors" has been studied, both with respect to the acceptability of the flavor imparted as well as the effects upon the storage quality.

The introduction of the Swedish Alfa continuous process of buttermaking has opened a new field of research in structure and consistency and the keeping quality of the butters produced.

Though most of the research work in progress is concerned with problems relating to market milk and cream, butter, and cheese, some work is being conducted on the method of manufacture and the keeping quality of dried milk, and on the properties of concentrated milks. This work has been carried out by laboratories of the SMR. A result of this work which may be of great significance is a process for making a dried milk of relatively high density. It is claimed that it disperses more readily than dried milks generally do.

A novel part of the work at the Alnarp Institute is that concerned with the testing of equipment. Here new types of equipment are tested for their suitability and ability to perform satisfactorily the tasks for which they were designed. Reports upon their construction and efficiency are made available to guide purchasers of equipment.

In general it can be said that the research laboratories are well equipped for the work on dairy products, especially for the work which is of a practical nature. The staff members are usually well trained in the fundamentals of the subjects concerned and the work is of good caliber and, through the cooperation of the Swedish Dairies Association and the State institutions, is well integrated with the practical phases of the industry.

CONSUMPTION OF DAIRY PRODUCTS IN SWEDEN

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Sweden is regarded as a country with high production and consumption of dairy products. Official figures bear this out, particularly when they are compared with those of other countries, including our own.

Table 1 shows the consumption of dairy products in Sweden in total and per capita, for the year 1939, just preceding the second world war, and for the year 1948 (1). Increase in consumption of each dairy product between those two years is immediately evident. A study of other records for previous years indicates an even more rapid rate of gain in consumption previous to 1939 (2). It has been suggested that strong increases in milk consumption during war years was due, at least in part, to the fact that milk was not rationed at that time.

Table 1.--Consumption of dairy products in Sweden: 1939, 1948

Product	Total consumption		Per capita consumption[1]	
	1939	1948	1939	1948
	1,000 tons	1,000 tons	Pounds	Pounds
Fluid milk[2]	1271.0	1601.0	453.2	506.0
Cream[3]	33.5	48.4	11.9	15.4
Butter[4]	70.5	94.2	24.6	29.9
Cheese[5]	42.9	54.3	15.4	17.2
Condensed milk	2.4	5.6	.9	1.8
Dried milk	1.4	9.0	.4	2.8

1/ Population averaged 6.33 million in 1939; 6.96 million in 1948.
2/ Standardized to 3% butterfat in 1948.
3/ Fat content kept below 17 percent in 1948.
4/ Dairy and farm butter.
5/ About 90 percent of the cheese consumed in 1948 was "semifat" (containing not more than 30 percent butterfat). Corresponding 1939 figure was 14 percent.

Dairy Products Consumption

A comparison of figures for per capita consumption of dairy products in Sweden for the year 1948 (Table 1) with published government figures (3) for the same year in the United States, reveals a higher consumption in Sweden of all products except the concentrated milks. Condensed milks, for example, total more than 20 pounds per capita in this country and the dry milks 3.4 pounds. In contrast, fresh whole milk in the United States averaged 302 pounds per capita for the year 1948; cream, 12.1 pounds; butter, 10 pounds; and cheese, 9.6 pounds (including 2.8 pounds of cottage cheese).

Ice cream is not readily available in Sweden and regular consumption

does not appear to have become an established habit. Average annual per-capita consumption there is estimated to be something less than one quart, in contrast to about 15 quarts eaten yearly by the average individual in the United States.

Fats in Swedish Diet

Table 1 shows the average annual per-capita consumption of butter in Sweden to be 29.9 pounds. In addition, 15.6 pounds of margarine is consumed annually along with 1.3 pounds of miscellaneous edible fats, making a total of 46.8 pounds of fat. Fat consumption in the United States makes an interesting contrast. United States Government figures for 1948 (3) show per-capita fat consumption to be a total of 64.6 pounds with the following breakdown as to kinds: butter, 10 pounds; lard, 12.7 pounds; margarine, 6.1 pounds; shortening, 9.6 pounds; bacon and salt side, 19.2 pounds; and other edible fats, 7 pounds. Jureen points out (2) that American consumption of fats of all kinds is on a very high level, and higher than the Swedish consumption which in turn exceeds most other countries. Butter represents 15 percent of the total fat, in pounds, used in the United States; 64 percent of that used in Sweden.

Calories Supplied by Dairy Products

In 1948, the Swedish diet is reported to have supplied a daily total of 3,040 calories per capita (2,4). (The per-capita consumption unit figure of 3,727 calories (5) may be more nearly comparable to the per-capita calorie figure 3,240, reported for the United States that same year (3).) Of the total calories supplied by the Swedish diet, about 24 percent was provided by dairy products. This is in contrast to the 17 percent contributed by dairy products (including butter) to the total calorie intake in the United States (6). The lower percentage figure for the United States undoubtedly reflects not only the lesser amount of total dairy products used but the proportionately lower amount of butter.

Protein in the Swedish Diet

The average per-capita intake of protein in Sweden was reported as 91 grams for the year 1948 (2,4) (99 grams per consumption unit (5)); in the United States, 96 grams (3). In this country dairy products supplied 25 percent of the total protein that same year (3) while the comparable figure for Sweden was calculated to be approximately 30 percent. The higher percentage figure for Sweden is to be expected, in view of a similar total protein intake and lower per-capita consumption of protein foods, other than dairy products. For example, Swedish people consume only two-thirds as much meat and little more than half as much poultry and eggs, per capita, as do the people of this country. Fish consumption more than triples that of the United States, on a per-capita basis, but it represents only about 2 percent of the total calorie intake in Sweden as compared with more than 40 percent for all animal products. With per-capita consumption of dairy products surpassing our own (cheese more than double) it is easy to see why dairy products provide nearly one-third of the total protein supply of the Swedish diet.

Other Nutrients

Full information on other nutrients in the Swedish diet is not at hand. It may be deduced, however, that dairy products contribute liberally to the average citizen's intake of the other nutrients, particularly calcium, riboflavin, and vitamin A.

In addition to the foods discussed in preceding paragraphs, the diet is complete with cereals, vegetables, fruits, and sugars. Cereal consumption in Sweden is slightly higher per capita than in this country; potato consumption nearly three times as great. Per-capita intake of other vegetables and of fruits and sugar in Sweden is less than our own. This is particularly true of vegetables and fruits, a fact which is reflected in a considerably lower per-capita vitamin C intake in Sweden (5, 3).

Maintaining Consumption of Dairy Products

Traditional enjoyment of dairy products is undoubtedly a factor in maintaining their consumption in Sweden. Furthermore, an organized effort is carried on to acquaint people with the nutritional importance of dairy products and the desirability of using them regularly to improve daily meals. Large glasses of milk are served at the family table, butter is available in liberal amounts at each meal, and both are used generously in cooking. It is not unusual to eat cheese at all three meals, and it is quite common to have more than one kind at the same meal.

A direct relationship between consumption of dairy products and the health of the Swedish people would be impossible to establish. However, it seems suitable to point out that as the consumption of dairy products has increased through the years, so also has the life expectancy of the people increased, infant mortality has declined, and the general health of the population has improved.

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OBSERVATIONS ON FLUID MILK PROCESSING IN SWEDEN

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The casual observer is probably more impressed with the mechanization of Sweden's fluid milk processing plants than any other single item. Extensive use of stainless steel equipment also attracts his attention. From the receiving platform to the bottling room, Swedish engineering skill seems to have been applied to eliminate all possible hand operations and yet move the product expeditiously through the plant. Someone has well stated that the larger milk plants are "as modern as tomorrow" in many respects.

Milk is brought to the receiving platform in round or in square 65-quart cans on wide, flat-bottom, open trucks or motor lorries. Apparently covered trucks have not been introduced as yet for transporting milk from the farm to the factory. Probably in Sweden's cool, dustfree climate, protection of milk in transit is not as important as in some other countries. Furthermore, quality control of the milk on the farm and in transport seems not to have received the attention which is given to it within the plant itself.

The milk is unloaded onto roller conveyors down which the cans travel past an inspector who loosens the covers and smells the milk. The milk surviving this first inspection proceeds to the weigh tank where the cans are dumped automatically. The receiving room is a busy, important place with attendants pushing panel buttons to record weights, control can movements, and facilitate test sampling. The alcohol, methylene blue, appearance and sediment tests seem to be the prevailing quality tests used. The cans continue untouched by hands to and through the can washer to be filled with return skim milk, then are reloaded onto the open truck for farm delivery. The unloading and reloading process is well described by Liliebladh, director of the Machinery and Building Department of The Swedish Dairies Association, as follows: "In the unloading of whole milk and the loading of skim milk for return to the producers, motor-driven roller or belt conveyors are nowadays used to move the cans. Tipping of milk into the balance-tanks is to an increasing extent performed by tipping machines, directly connected to a can-washer where the cans are again reversed and conveyed to the milk lorry via the skim milk filler. The manual labor is confined to the actual loading and unloading at the lorries. One man is needed to run the tipping machine and note the weights, and another at the filler for return skim milk."

Meanwhile, the milk is filtered and pumped into huge vats preparatory to pasteurizing, separating, and standardizing. Since about 70 percent of the total milk weighed in is used for butter manufacture requiring many large separators to handle the product quickly, separating becomes a big operation. The skim milk is returned to the farmer in proportionate amounts of production. Laws require the returned skim milk to be pasteurized. Consequently, all milk is H-T, S-T pasteurized at 72° C. (161.6° F.) before separating. Separating is done in batteries of large capacity Alfa-Laval centrifuges. The skim milk being returned to the producer first goes to a dosing tank where it is acidified with formic or acetic acid. From the dosing chamber, the skim milk is metered into the cans through a foamless valve. The dosing outfits for the acidification of return skim milk, the foamless valves as well as the automatic can tipping and washing machines and measuring devices are all devised and manufactured by Wedholm's Ltd., a member of the

Swedish cooperative set up solely to design and manufacture dairy machinery. Thus, by returning the surplus skim milk--that not used for cultured buttermilk, for standardizing milk or for other purposes--to the farm for feeding purposes, the surplus skim milk problem is easily solved.

In order to extend the butter supply, the Swedish government passed an act in 1942 stipulating that market milk should be standardized to 3 percent fat. Fat rationing ceased in March 1949, but this regulation continues in force. Hence, standardizing the percentage of fat in the milk to a lower percentage is a regular part of processing, and enhances the amount of fat for buttermaking.

Milk bottling is done in separate, well-lighted and ventilated rooms with modern vacuum fillers. Glass bottles are generally used although paper containers of the Perga type were introduced and tried out, but have never competed seriously with the glass bottle. The bottles seem to be of cheaper quality, having small, 27-millimeter openings. Closures of the Dacro type made of laminated paper and aluminum or of other metal are used. Conspicuous by absence in the bottling room are leaky lines, overfilled bottles, dripping valves and spilled milk. In fact, milk seems to be handled as though every drop were precious.

Chocolate milk has not been introduced in Sweden. Neither has homogenized nor D-vitaminized milk. Hence, there is no processing along these lines. Considerable quantities of cultured buttermilk are made, however, using standard procedure.

Heavy cream was discontinued during the war as a fat-extending measure. The cream processed and packaged today contains from 13 to 15 percent fat, homogenized. Generally, it is poured into metal tubes, somewhat like large tooth paste tubes, and sterilized. Obviously, the cream is of relatively low viscosity, but as a result of the high heat treatment of sterilization, has a pleasant, nutty taste. Much cream is sterilized in bottles also.

Washing of equipment is mechanized wherever possible. Separator discs, as a unit, are put into a special rotating closed washer. Flush, circulating-solution-washing of H-T, S-T pasteurizers prevails. Modern research laboratories check cleanliness. In 1936 a bacteriological control system directed by the dairies themselves for checking the effectiveness of cleaning and quality of the products was organized. Total bacteria counts and presence of coliaerogenes bacteria are obtained. Experience has shown that this bacteriological control system is most valuable not only in attempting to raise the bacteriological quality of the pasteurized market milk, but affords a reliable indication of the effectiveness of the cleaning procedure at the dairy.

Emphasis seems to be placed on laboratory control throughout. At the central milk plant in Stockholm (Mjolkcentralen) a modern, well-equipped and ably staffed research and control laboratory is maintained. Here, not only routine control but fundamental physical, chemical, and bacteriological research is carried out. In checking the efficiency of pasteurization the phosphatase test is used. Fat tests, naturally, are a part of the control of the uniformity of the product. The Gerber test is generally used in smaller dairies, but the Lindstrom fat test for milk prevails in the larger ones. The Rose-Gottlieb method is used also in much control work. The Lindstrom test, ultramodern and relatively rapid, utilizes but a small sample of milk injected into the test tube by means of a syringe somewhat like a hypodermic needle. Only one centrifuging is necessary as water is introduced while centrifuging to bring the fat into the reading column. Many tests on milk from producers may be run at one time.

In brief, Sweden's fluid milk processing in the larger cities reflects engineering skill, efficiency and cleanliness throughout. The care given to quality of milk processing in Sweden is reflected, in part, in the health of her people and in her high per-capita consumption of dairy products.

DAIRY MACHINERY AND EQUIPMENT IN NORTHWESTERN EUROPE

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Inspection of many dairy plants in northwestern Europe during the summer of 1949, and numerous discussions with dairy authorities have brought to light many items that are of interest to the American dairy industry.

The purpose of this paper is to make note of some of the most interesting observations relative to the machinery and equipment phases of the industry in northwestern Europe, as well as to make some mention of the design and construction of dairy plants.

In Sweden there seems to be a great tendency toward centralization of manufacture, which has resulted in the building of relatively large plants with rather complete facilities. The milk is picked up at the farm or frequently at a small milk collecting point such as a crossroads intersection, and the milk is usually trucked to the plant from as far as 100 miles away.

The newer Swedish dairy plants are models of perfection, and are constructed with tile floors and walls. High ceilings, 14 to 16 feet in height, are common in the processing rooms. The use of tile wall coverings extends to and includes the boiler room.

Considerable attention is being given to automatic conveyors and such items as cheese turning and paraffining apparatus. Milk is usually stored in large stainless steel vats on the second floor, and these tanks are set into the second floor slab which extends to the first floor. These tanks are often in special rooms made for the purpose. The large plants are thoroughly departmentalized. Most of the plants have special facilities for recreation and the feeding of employees. Moreover, many of the plants seem to be safety conscious, and are fitted with safety signs, guard rails, etc.

Milk plants in Norway and Denmark followed somewhat the same pattern as in Sweden except that they did not make as extensive use of stainless steel. In Denmark, particularly, there was more use made of small country plants. These plants were well-designed and finely built, and the typical plant had a tile roof and brick side walls. In the Danish country processing plants, it is customary to provide living quarters for a majority of the employees.

Milk Receiving Rooms

The large milk plants in these three countries were equipped with continuous type can washers of the jet washing variety, which were bulkier and required more floor space than in American plants. Some of the plants were equipped with automatic can dumpers, and others were equipped with a semi-automatic weighing device. In the smaller country plants in Denmark most of the can washing was done by hand.

The Pasteurizing Plant

Most of the plants were using a plate-type, high-temperature short-time pasteurizer, similar to the heat exchanger in use in the United States. It was noted, however, that in Denmark a few of the Stassenizer pasteurizers were still in use. In the newer Danish country plants, the plate heat exchanger is used for pasteurizing cream that goes into butter.

It is of note that in most of the milk plants the pipe lines and equipment are cleaned without dismantling, by merely circulating cleaning solutions through them, which is followed by chlorination or steaming, or both. Furthermore, in most of the newer plants, all of the service lines--steam, water, etc.--are carried under the processing room floor or behind a wall so that only a short length of line is actually located in the room.

Milk bottling operations varied considerably, but in most plants the milk bottle is of the small-neck type and a metal cap similar to that used on a soft-drink bottle in this country was used. Either gravity or vacuum type fillers were used. Bottle washers were rather large machines, and both the jet type and the soaker type were in use.

Butter Making Machinery

Most of the butter churns in use in Sweden were the large wooden drum type, very finely kept, and set in tile surroundings. Large churns were also used in Norway and Denmark, although the Danish Cooperative is now using a metal alloy churn of double cone shape in some of their country plants. This churn is a development of the Danish Cooperative.

There is much interest in the new continuous churn of which the Alpha Laval and Fritz machines are the two principal types. Only a few of these machines are in use and they are still in the developmental stage. The Alpha Laval machine, which is manufactured in Sweden, is being used in one of the plants of the Swedish Milk Cooperative. With this machine, fresh fluid milk is passed through air-tight separators and the resultant heavy cream is then chilled, agitated, and mixed with the necessary salt flavor and color, and extruded into an automatic packaging machine. During the passage through the machine the heavy cream has its phase reversed and butter is thereby formed. This machine offers possibilities for great improvement in sanitation, in fat losses, and in more efficient use of labor.

The Fritz machine, which is manufactured in Germany, is a more compact machine. It is being used principally in Germany. It takes ripened cream of from 35 to 45 percent fat content, passes it through a high speed churn, then automatically separates the buttermilk from the butter, and extrudes the butter into tubs or a packaging machine. Under normal conditions, the butter is cooled for several hours before printing and packaging.

Cheese Making Machinery

Cheese manufacture, which is an important business in these countries, has resulted in the development of a considerable amount of specialized machinery, including a variety of designs of power agitators. Multigang vertical type presses are found in most plants, also. Some attention is being given to hydraulic operation. Large plants are equipped with plate-type heat exchangers, automatic conveyors, and automatic turning and paraffining apparatus. In Germany, an automatic continuous-type cheese machine is being developed.

Ice Cream Making Machinery

The ice cream business is not extensive and therefore there was little ice cream making equipment to be seen except in particular locations. Denmark has some new continuous-type ice cream freezers of their own manufacture.

In Great Britain, there are quite a number of ice cream freezing installations. Several large operations are being carried on, one of which is a continuous freezer to freeze ice cream and then extrude it onto a wooden slab. The slab is passed through a quick hardening tunnel operating at minus 40 degrees F., and in about half an hour the hardened slab of ice cream is discharged, and run through an automatic cutting and wrapping machine. The small, individually wrapped packages are then ready for sale.

Much of the dairy equipment in the European dairy plants is of pre-war design and age. Much of it is badly worn and it is being replaced with more modern equipment as rapidly as possible under postwar conditions.

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